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EDITORIAL NOTES—GAS, &c.

The Vertical Retort from the Chemist's Standpoint.

If we except the late Mr. William Young, British chemists learned in gas-works processes have hitherto been silent over the vertical retort and its performances; and therefore it will be with particular curiosity that our readers will turn to the lecture which Dr. Harold G. Colman delivered on Saturday last to the Manchester and District Junior Gas Association, for in that lecture he constructed a very sound case for his belief that in the vertical retort we have, judged by the chemical and physical principles of carbonization, the nearest approach to ideal carbonization that has yet been evolved. True it is that we have not a finished knowledge of all the actions, reactions, and changes that take place inside a retort, and which influence carbonizing results either advantageously or disadvantageously; but knowledge of these matters has been undergoing expansion recently, and not the least of the contributors to that knowledge have been those who have been so ardently engaged in working upon the vertical process of carbonization. Theories have been proved and endorsed by their experiment and practice; but still incompleteness in the knowledge of carbonization reigns, and finality appears to have no boundary line that can be even approximately determined in the present day.

Step by step, Dr. Colman unfolded the conditions valuable to carbonizing result, and those that are otherwise; and applying the knowledge to the varied issues of the working in horizontal, inclined, and vertical retorts, he deduced that the balance of advantage is distinctly on the side of the vertical retort, if commercial and engineering considerations fulfil their promised end. The gas chemist will rejoice in the vertical retort if there is this fulfilment, for therein are the ideal conditions realized for the best chemical effect from carbonization, which high temperatures and the large free space at the top of horizontal and inclined retorts stubbornly resisted. In practice, we want high temperatures to obtain the maximum yield of gas and (though this is not always desirable for domestic purposes) a hard dense coke. But the gases and vapours evolved must not be depreciated in illuminating and calorific power, the yield of ammonia must not be minimized, nor the naphthalene and carbon bisulphide increased or the tar thickened, by further exposure to high temperatures. In the horizontal and inclined retorts, by employing high temperatures we get a large yield of gas and a decent coke; but in their train are frequently very disagreeable troubles—the higher yield of gas being counterbalanced by a reduction in quality, by a thicker tar resulting in stopped ascension-pipes and pitching-up of hydraulic mains, by formation of larger quantities of naphthalene and smaller quantities of the light tar oils, and by an additional amount of carbon bisulphide. The cause of these troubles has been tracked; and, knowing the cause, we know the conditions necessary to evade them and yet to realize all the advantages of high-temperature carbonization. Knowing the necessary conditions, however, is an altogether different matter from producing them. But the gas industry is fortunate in this regard, in that there is good reason now for the belief that these conditions are found assembled in the vertical retort; and that is Dr. Colman's belief, expressed in the words the vertical retort gives us a method whereby the coal can be heated to a very high temperature, without simultaneously causing great heating of the gases and vapours produced—the latter condition being due to the fact that, in the vertical retort, the greatest volume of the evolved gases and vapours takes the path of least resistance through the charge, and that is the central vertical core of coal before its complete carbonization. The accumulated results of experimental and ordinary daily work all show that a good yield of gas per ton is produced, and that the evils of stopped pipes and naphthalene are averted, that carbon bisulphide is reduced, that the ammonia is increased, and that a harder coke is realized.

But while the yield of gas is good, and while theoretically the quality should be higher, in the vertical retort than in the horizontal, the evidence does not from all quarters substantiate Dr. Colman's assertion, if applied to illuminating power, that "the quality of the gas produced, particularly its calorific power, is decidedly higher." Take Herr Körting's Institution paper of 1906. He there stated that, with good Durham coal (Boldon), the gas produced per ton of coal was 11,700 cubic feet of 13·5 candles—that is to say, without steam. When steam was admitted, the production rose to 13,250 cubic feet, and the illuminating power fell to 11 candles, though in both cases the calorific power was good. We believe, too, that in more recent tests in the Dessau form of retort the illuminating power of gas from Boldon coal has not consistently been even so high as 13·5 candles when the make has been rather below that quoted in the paper. We know that, with Boldon coal, in horizontal working a much better illuminating power can be realized by yielding a few hundred cubic feet of gas. But at the same time, Dr. Colman will possibly claim, and rightly, corroboration of his remark in the tabular statement we published a fortnight ago of a three days' run of the Woodall-Duckham retorts at the Nine Elms Gas-Works; the average production per ton from Burley Silkstone coal being 12,633 cubic feet, of an illuminating power of 15·82 candles. The question of illuminating power, as we have previously pointed out, is not one that can be neglected in this country while the parliamentary standard test of the quality of gas is based on illuminating value.

Dr. Colman divided the vertical retorts into two classes—the discontinuous and the continuous. "Discontinuous" is an ugly descriptive word as applied here; for the system so styled is only "discontinuous" in the sense that the retorts are intermittently charged and discharged. Therefore we should prefer the term "intermittently charged," in contradistinction to continuously charged. In the discontinuous class, Dr. Colman includes the Dessau and Mr. Love's retorts (though the latter are not strictly entitled to inclusion, being placed at an angle of 45°. But like influences arise through the method of working as in Dr. Bueb's retort). In the continuously operated class, he places the Settle-Padfield, the Woodall-Duckham, and the Young-Glover retorts. In the classification of the Settle-Padfield retort, Dr. Colman has made a slip. It comes between the two classes, in that the system embodies continuous charging and intermittent discharging. After discharging, only a small base of spent coke is left in the lower or inclined portion of the retort. Consequently, during the early period of each complete charge, the gases and vapours evolved are exposed to the high temperature of a large free space; and, moreover, as the charge increases in height, so the gases and vapours are subject to variable degrees of exposure in the diminishing free space. Dr. Colman would not countenance this as an ideal condition conducing to uniformity of product. It was the variable space which partly led to the undoing of the Settle-Padfield system, and which brought us the knowledge that continuous charging must be accompanied by continuous discharging, such as in the Woodall-Duckham and Young-Glover systems. To such systems as the latter, Dr. Colman attaches himself when he says: "Working in this way, "the chemical changes going on are always approximately "the same instead of varying according to the length of time "the charge has been in the retort as is the case with "'discontinuous' charging. Hence the gas given off is of "more uniform quality." Having said this, Dr. Colman does not consent that chemical considerations shall finally determine the relative advantages of the two—continuous and intermittent—systems of vertical working, which relative advantages, in his opinion, will have to be decided more on engineering and commercial lines. We quite admit the dominating influence in the decision of commercial considerations; but as to engineering considerations, it is easier to fit

engineering to chemical requirements than *vice versâ*—the vertical retort itself is demonstrative of this. The lecture, while of immense value to the junior student, puts before all concerned in this subject the case for the vertical retort from the chemical point of observation, in a manner that will both interest and influence.

The Franco-British Exhibition.

More has been heard during the past week of the arrangements for the Franco-British Exhibition at Shepherd's Bush. The Executive Committee of the Exhibition know the value of advertising betimes what their intentions are; and thus it came about that on Thursday there was a Press reception and a luncheon, and the evening and morning papers duly sang the praises of the great enterprise, which, there can be no question, will prove a big attraction during the six best months of next year. Some 140 acres of land will be occupied by the exhibition; and so considerable an area, with its twenty exhibition buildings, and extensive provision for outdoor pleasure, will tend to induce visitors to make a selection of the sights and entertainment offered that will be most congenial to them in the summer time. If it is fair to form some estimate of what will be the public taste by the principal reports in the Daily Press of last Thursday's reception, then the great area to be devoted to Olympic Games will be the centre of attraction, other amusements will come next, and the housed exhibits will receive such remnant time as a recreation-seeking public choose to bestow upon them. Wherever we seek in the country for information, this appears to be the general view of maunfacturers: and it would seem that the manufacturers of France are much of the same way of thinking. True it is the Paris Municipality have voted £12,000 with the view of ensuring that the French Section of the exhibition shall be thoroughly representative of the industries of France. But so supine are the electrical interests of France over the exhibition that we hear of a special whip having been sent round to try to animate them; and in this country the electrical manufacturers are going to give the Manchester Exhibition their preference, and it is only expected that "some kind "of an electrical show" will be made at Shepherd's Bush.

With regard to the Gas Section of the exhibition, is it not time that the statement was dropped that something must be done "to show that the industry is not dead," and to "keep "our end up"—expressions that have been employed now at two dinners at which representatives of the industry have congratulated themselves that it is to-day in a particularly lively and healthy state. Looking round at the prosperity of the industry, it can only be imagined that the expressions are indulged in with—shall we say?—"the tongue in the cheek." Let it not be again confessed, with all that is being done by every enterprising gas company and committee in the country, that it requires an exhibit established on a small share of those 140 acres at Shepherd's Bush to "show that the "gas industry is not dead, but liveth." At the dinner of the Society of British Gas Industries last Thursday, Mr. James W. Helps, as Hon. Secretary of the Gas Section Committee, made a statement on the subject; and we rejoice to learn that the Committee—still believing that the Shepherd's Bush Exhibition will afford an excellent opportunity for advertising the merits of gas during the six summer months—will have the necessary funds at their disposal for doing what they consider proper. Those funds will be subscribed by Gas Companies in and about London whose views are in agreement with those of the Committee. This will be the first time in this country that the expense of a public display in the interests of gas has not fallen upon gas plant and appliance manufacturers and contractors, though, in other countries, the administrations of gas undertakings, as we showed just recently, regard such expense as their own obligation, though we should not be disposed to say it should always be without participation by plant and appliance manufacturers. In the "Journal" last week, too, it was mentioned that the Turin Consumers' Gas Company have already subscribed £2000 towards the Industrial and International Exhibition to be held in that city in 1911.

But with reference to this question of the bearing of the expenses for the Gas Section of the Franco-British Exhibition, Mr. Helps's remarks appear to be a little obscure; and we hear they have left manufacturers in some uncertainty. He said the Committee had funds at their disposal; that it was intended by the Committee to do all they possibly could to take the burden off the hands of the manufacturers; that efforts were being made to get the present heavy price of space reduced; and while not asking the manufacturers to do anything, he suggested that they might do something. Between these various statements, the manufacturers are not clear whether the Gas Section Committee propose from the funds at their disposal to provide space free for the manufacturers to furnish with gas appliances and apparatus, or whether the suggestion is that the manufacturers should do something—defraying the whole expense from space to close of the exhibition for their share, if any, in the display. If the Committee could only see their way to formulate, in conjunction with the manufacturers, a scheme on the former lines, something effective might result, notwithstanding the general feeling among manufacturers that a six months' summer exhibition at Shepherd's Bush will not be so profitable a way of spending money in demonstrating the utilities of gas, as an independent exhibition at a time and in a place where greater attractions do not abound.

There is just one other matter. This question of the Gas Section at Shepherd's Bush is purely one of business policy for every firm and gas company concerned to determine for themselves; and it is hoped that no one, whatever may result from a division of opinion, will make it a personal matter. We cannot think, though we have heard it suggested as a possibility, that anyone will reduce it to that. To quote the Earl of Rosebery: "It is only people of little "faith and thin convictions who never differ with each other "on public policy. When you have convictions and faith, "you are bound to differ at some time or other with most "men. But this, at least, we have always cherished in our "life as a guiding principle, that those differences of opinion, "where they do not touch personal honour, should never in "the slightest degree affect personal friendship."

Science and Practice and Open Gas-Fires.

The proceedings at the autumn meeting of the Society of British Gas Industries were pointed with matters of importance to the gas industry. Head and front stood the address of the President, Mr. Dugald Clerk, in which he treated upon that evergreen subject of the relations of Science and Practice. His essay proved the interdependence of the two (assuming always that by practice is understood successful practice), and that there is no clear demarcation between them. There may be practice that is unscientific, but that cannot be wholly successful practice. Practice, he tells us, cannot always wait for science; had it done so, there would not have been the great achievements that we witness to-day. But it must be submitted that in the practice (whatever its nature) which has resulted in great achievement, though science may not intentionally on the part of the originator have been brought to bear upon his labours, there must have been an involuntary application of scientific principles, which possibly had not at the time been reduced to concrete law. Practice cannot successfully walk independently of science; and, on the other hand, science in its application to practice must not be of itself unpractical. In the gas industry, devotees of science have, it is written in history, been the means of imposing burdens on the industry, which the modern records show have been brought into such ridicule by practice that there has eventually been removal. The best work, however, has been done where the reciprocal relations of science and practice have been fully recognized, and the relationship turned to account. That is why we have been earnestly advocating the incorporation in the training of men who will hereafter have upon their shoulders the practical work of an industry that stands, and increasingly so, in every department upon a scientific base, of a comprehensive knowledge of those principles that will assist in guiding their practice to the most valuable ends.

Turning to the second part of the address, with all deference to Mr. Dugald Clerk, we must submit that he was far from being justified in his condemnation—not only of flueless gas-stoves, but of open gas-fires as producers of carbon monoxide. His experience must have been founded on gas-fires of a past day; indeed, in his reply to the discussion, he admitted that "he had recently looked at the gas-stove "question, and was glad to see great improvement." If Mr. Clerk had made his investigations on modern open gas-fires, he would have doubtless come to the same conclusion, arrived at from a series of carefully conducted experiments, as Mr. J. H. Brearley presented in his Institution paper last June—viz., "One may say that gas-fires do not produce car-"bon monoxide when properly constructed and kept clean.

"It has been proved that, when a gas-flame comes in contact with cold surfaces, carbon monoxide is produced. But so far as gas-fires are concerned, this is entirely avoidable; and, indeed, if neglected, it only concerns the first few seconds after the fire is lit." We need not, with modern gas-fires before us, labour this point; but there must be protest, if the assumption is correct that Mr. Clerk's experience is founded upon past productions of an indifferent order, against this censuring of present-day production. Science must be up-to-date before pronouncing judgment on anything that is the result of the union of scientific principles and practical considerations. We do not say that gas-fires cannot be improved; if they can, it will be in the direction of securing from them even greater efficiency for a given expenditure of gaseous fuel. It may also be admitted that there are still ill-constructed fires on the market, as there are ill-constructed examples in most lines of goods. But because of this, because there is after-negligence, and because gas-fires are occasionally fixed in unsuitable situations, there must not be indiscriminate condemnation. If Mr. Clerk continues to think he is justified in his denunciation, then—he believes in gaseous fuel, and regards heating by solid fuel as a barbarous method—let him exercise his inventive faculties, and give to us a gas-fire that, in his opinion, will be above reproach. Meanwhile, one suggestion made in the course of the discussion was that gas companies and committees would benefit their gas-heating business by having periodical inspections of all gas-fires fixed in their areas of supply. This is practised at St. Helens; and the point is worth consideration.

Coalite in Parliament.

THE British Coalite Company are making a fresh move. An essential part of their original scheme, so far as it relates to London, has fallen through—that is, the making of terms with a Gas Company to relieve them of the gas produced in turning out coalite. Without they can make money on the gas, their coalite business will be in a bad way in its competition with other solid fuels. The Gas Companies failing them, they are having recourse to an application to Parliament to enable them to distribute for power and heating, &c. (except illumination), the gas made at their Barking works in East and West Ham, Barking, and North Woolwich—that is to say, in the great industrial area of London. In the "Gazette" notice of the application, the works the Company are going to put down at Barking are described as "gas-works"—not coalite works. The Company are in a difficulty; and it is Hobson's choice with them. They have to adopt, if they can get parliamentary powers, the most expensive means of disposing of their gas, and the most expensive means of disposing of their gas will not raise their capacity for selling coalite at a low price in relation to the cost of other fuels. The expense of this parliamentary application, and a heavy capital outlay in putting down a gas distribution system for a questionable amount of custom, were hardly contemplated by the shareholders; and, if the measure succeeds, it may be accompanied by limitations in respect of dividend and price and other conditions that the shareholders may not willingly approve. We shall be interested to hear what is said on the subject when the Wharncliffe meeting is held. The Company, of course, cannot expect to get through Parliament without encountering strong opposition on the part of the Gas Companies and electricity supplying local authorities who are powerful in the districts that the Company are proposing to supply. To what profit, too, do they expect (assuming parliamentary authority be granted) to supply the thinned-down high illuminating power gas they will produce, with other cheap gas and electricity and suction and producer gas plants in competition? The speculative spirit of the Directors, under the pressure of circumstances, is rising fast. The Company were expecting to be making coalite at Barking very shortly. As the Bill will not receive the Royal Assent, if it ever gets to that stage, before next July or August, and they cannot start the construction of the gas distribution system before then, and customers have to be obtained for the gas, we can imagine the delay will create further disappointment among the shareholders who were induced to sink money in the concern on the strength of a puffing that has been altogether unmatched in the history of modern flotations in the City. Advice has been given that Gas Companies should link themselves to the fortunes of the Company. Gas Companies, with statutory obligations, are better without such uncertain connections.

Suggested Gas-Works Foremen's Association.

Mr. Tysoe's paper, published last week, which detailed a simple and ingenious method of patching holder plates—an idea originating from the mind of a foreman—recalls a suggestion made by the author in his Presidential Address to the Southern District Association a few years ago. It was to the effect that a Gas Companies' Foremen's Association should be formed, giving them the same opportunities which are now enjoyed by the managers and the junior officials. This idea, if carried into practice, would inevitably result in considerable benefit to the foremen and the companies they serve. Their experience would widen; and "rule-of-thumb" methods would make way for more modern and improved ideas. Several hundreds of foremen must be employed by the London and Suburban Companies; and there is nothing to prevent them meeting together with the object of exchanging views and arranging visits to their respective works. The reading of papers by these practical men would certainly bring to light many bright ideas which otherwise would be buried in obscurity. It should be of no small advantage to the gas industry that a wise Parliament many years ago ordained that each undertaking should have a monopoly of the gas supply in a specified district. Each is therefore an ally, not a competitor, of its next-door neighbour. This being so, experiences should be related and difficulties discussed; and no better medium could be found for the exchange of information than a Foremen's Association. Mr. Tysoe, having made the suggestion, would undoubtedly give it his support. The formation of an organization of the kind needs nothing more than the approbation of a few of the London and Suburban managers; for it is not to be doubted that the foremen as a body would welcome the materialization of a suggestion which was made with the idea of broadening their views, and adding somewhat to the interest of their work.

An Interesting Compensation Case.

In view of the increased liability imposed upon employers by recent legislation directed to securing compensation to workmen in the event of accident, special interest attaches to a case decided by the House of Lords on Monday last week, and reported in our "Legal Intelligence." It was an appeal *in formâ pauperis* by a widow, on behalf of herself and her children, from a judgment of the Court of Appeal setting aside a decision of a County Court Judge granting her compensation in respect of the loss of her husband. The man was employed as a stoker at the Beckton works of the Gaslight and Coke Company, and on Feb. 12, 1905, he met with an accident which caused injuries to his neck. On the assumption that these were the result of the accident, an agreement was shortly afterwards made and filed in the County Court, under which the Company allowed the man 18s. per week as long as incapacity lasted. He, however, died in March last year. The Deputy-Judge of the County Court found that, though there was no evidence that death was caused or accelerated by the accident, and that, as a matter of fact, the man died from a disease from which he was suffering, the Company were estopped, by the agreement into which they had entered, from denying that the disease was the result of the accident; and he made a decree for £249. Against this decision the Company appealed; and the matter came before the Court of Appeal in June last. It was submitted on behalf of the appellants that there was nothing in the agreement which could create an estoppel in the event of death; and that they could at any time say the incapacity caused by the accident had ceased and that, therefore, they were no longer liable. On the other side, it was pointed out that the man was perfectly healthy at the time of the accident, but soon afterwards the disease supervened from which he died. The Company had two courses open to them—either to dispute or to admit liability. They chose the latter course, and the agreement was the result. If the Company agreed that the incapacity was due to the accident, they could not afterwards say that death was not the result of it. This was the point on which the respondent's Counsel relied. The Court were unanimously of opinion that the case was one in which estoppel could not apply, inasmuch as it would have been open to the Company at any time to say the agreement into which they had entered ought to be varied or discharged, because what was a matter of belief at the time it was made had been subsequently disproved. There was an express finding by the County Court Judge that death was not the result of the accident; and there-

fore estoppel did not apply. When the matter came before the House of Lords, the arguments adduced in support of the widow's case failed to convince their Lordships; and, without calling upon the respondents' Counsel, they dismissed the appeal. The Lord Chancellor laid it down that the agreement only amounted to an admission that there had been an accident, and that the Company were liable to pay compensation for it. The man's death was, however, held to be not due to the accident, but to an obscure disease; and therefore the liability was removed. Though the widow was confessedly not in a position to defray the expenses of her appeal to the House of Lords, it was well that her case was taken there, as the unanimous decisions of the two highest legal tribunals on the point raised will be valuable as precedents in any similar case that may arise.

Opening of the Ammanford Gas-Works.

The history of the inception of the project for lighting by gas what has been described in a local paper as "the rising town of Ammanford"—an "important centre" in the mining and tinplate district of Carmarthen—is pretty well known to our readers. It was, if we remember rightly, originally intended that the District Council should establish gas-works for the lighting of the urban area; but, fearing that the Local Government Board would refuse to sanction the necessary loan until the Council had carried out water and sewerage works, it was deemed advisable that the gas supply should be furnished by a private Company. We learn from a highly coloured article in a local paper, that "the idea caught on with a few local gentlemen." But it evidently did not prove sufficiently attractive to enable them to realize it; and it consequently fell through. Thereupon, we are told, "some London gentlemen came to the rescue," and the formation of the Amman Valley Gaslight and Coke Company, Limited, with a share capital of £25,000, was the result. A site was secured, and the erection of the works was entrusted to the Gas Supplies and Construction Company, in regard to which concern our readers have had particulars from time to time. It will be seen from the report which appears in another part of the "JOURNAL" to-day, that the works were opened on Saturday. It is rather curious that, seeing the District Council were the originators of the idea of introducing gas lighting, they were not strongly represented at the opening ceremony; but there may have been good and sufficient reasons for this. Of course, at the luncheon in connection with the function, the Company were wished prosperity, and the opinion was expressed that the population in their area of supply would grow in the near future. Those, however, who know the scattered nature of the district, and the kind of house property in it, consider that the business will never be sufficient to pay the interest on the capital invested. The village itself is, we are informed, a very small third-rate one; and though the Company are said to have made a hundred installations of gas, and to have 2000 orders upon their books, some people are unkind enough to say that it is doubtful whether the last figure divested of a cypher will represent the numbers ten years hence.

The Duties of Elective Auditors.

There has at different times been a good deal of discussion as to the precise duties of elective auditors appointed by the ratepayers to investigate the accounts of local authorities. In particular places it is frequently to be noticed that these gentlemen devote a disproportionately large portion of their reports to matters which in many quarters would be apt to be considered as of minor importance—such as the number of cigars and bottles of wine consumed at luncheons, the amount of money expended on cab fares, and things of that kind. But even though these "revelations" may not be actually approved of, they are as a rule allowed to pass unchallenged. There are, however, limits to the criticisms which may be indulged in, without fear of unpleasant personal consequences, by those who accept the responsibility of reporting to fellow townsmen on the financial position of the municipality; and if a reminder on this point is necessary in any other instance than that of the defendant in a slander action decided last week at the Liverpool Assizes, the verdict of the Jury in that case may be relied upon to provide it. The verdict is a serious one for the defendant (who is credited with socialistic views, and is Elective Auditor at Wigan); for, in addition to the £100 damages awarded, the cost of the trial, which lasted several days before a Special Jury, must be very heavy. But it is not likely to be generally regarded as being any too severe, having consideration to the charges which the defendant was found to have unjustly launched against the plaintiff—an Alderman, ex-Mayor, and Chairman of the Electric Light and Tramways Committee, of the Wigan Town Council. What the slanderous statements consisted of, it is unnecessary here to record; they concern the plaintiff in the action. The moral is the important thing from a general standpoint; and this is that elective auditors, like other persons—and particularly those holding responsible positions—should "look before they leap." It is at no time more necessary to be sure of one's facts than when issuing broadcast statements reflecting on the conduct of others. When summing up, Mr. Justice Pickford remarked that the public administration of corporations and other great bodies should be pure; and they perhaps could not have a better instance and example of this than some of the allegations one had seen made at inquiries going on lately in London. It was also extremely important that in the attempt to keep it pure, allegations of dishonesty should not be made against individuals unless they were true. It was further of great importance that elective auditors should be at liberty to comment perfectly freely upon all the matters they found out in the course of their duties. They were elected in order to find out if there was anything wrong in the interests of the ratepayers, and to bring it before the ratepayers if they did find it; and they undoubtedly performed a very useful function in doing so. But they should not be led by their looking for irregularities into making unfounded allegations. A man commenting on a matter of public interest, might comment as strongly as he liked; but he must not make allegation, which was not a comment, but an allegation of fact, unless he was prepared to prove it, and show that it was true.

The Vacant South Metropolitan Directorship.

We understand that Mr. Frank Bush, the Secretary of the South Metropolitan Gas Company, will offer himself as a candidate for the seat on the Board rendered vacant by the recent death of Mr. Simpson Rostron, the Vice-Chairman of the Company, and that he will have the unanimous support of the Directors, in their capacity as shareholders, believing as they do that the best interests of the Company will be served by Mr. Bush becoming one of their colleagues. The filling of the vacancy is, of course, a matter for the shareholders' decision in general meeting; and therefore nothing can be done until February next. Should the views of the Board in regard to Mr. Bush be shared by the proprietors, as we have not the least doubt they will be, the secretaryship will necessarily become vacant; and it has been decided to appoint Mr. F. M'Leod, who is at present in charge of the Inspectors' Department. Some of our readers may remember that Mr. Bush was appointed Secretary in February, 1882, when the position was relinquished by Sir George Livesey. Mr. M'Leod, who was an officer of the Phœnix Gas Company, was transferred to the South Metropolitan Company on the amalgamation in 1880.

How to Deal with the Vexatious Circular-of-Inquiry.—Referring to the paragraph headed "As Director or as Councillor?" in the last number of the "JOURNAL" (p. 548), a correspondent who has evidently had personal experience of the circular-of-inquiry nuisance, writes as follows: "Giving publicity to the matter, if it does not stop the issue of such circulars-of-inquiry, will tend to stop them from being replied to. It is not unlikely that some gas managers might feel doubtful as to the policy of refusing to reply to inquiries of a director of a neighbouring gas company. You have in the past, on several occasions, called attention to the matter; and I hope the day is not far distant when there will be a general understanding among gas officials that no replies shall be sent in any cases of the sort."

The "Water Arbitration Prize."—Our readers are aware that the Institution of Mechanical Engineers last year received from the Metropolitan Water Board and from Sir Edward Fry, the Chairman of the Court of Arbitration under the Metropolis Water Act, 1902, two sums of £250 each, which were placed at the disposal of the Council to utilize as they thought fit in the promotion of some engineering purpose connected with the Institution. The Council decided that the amount should be invested, and that the interest should be utilized in offering biennially a prize of the value of £30, to be known as the "Water Arbitration Prize," to take any form which the Council might decide upon. The prize was to be offered for a paper on an engineering subject to be announced by the Council one year before the time of sending in the papers; and for the first year of the award (1908) the subject selected was "The Filtration and Purification of Water for Public Supply." The date for receiving papers was at first fixed as the 31st ult.; but the time was subsequently extended to Jan. 3, 1908. At the meeting of the Institution on the 15th inst., the President announced that a further extension had been granted by the Council; the latest date for receiving papers being now fixed as July 3, 1908.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 665.)

THE week just closed on the Stock Exchange has had its full measure of interest, and, like an April sky, was an alternation of sunshine and cloud. The opening was remarkable; for the measures taken by the United States Government to deal with the currency deadlock were enthusiastically greeted, as if they were an infallible instantaneous cure for everything. Markets executed a complete *volte-face*, all rising freely, while bears hastened to cover, and prices were run up against them. Tuesday opened on the same lines. The ardour, however, quickly began to cool, and business fell very quiet, with lower prices, as it was seen that the drain of gold had not stopped. Wednesday was dull, with disappointment at the result so far of the U.S.A. measures and the stiffening of money over here. Prices shrank again. Most markets were flat on Thursday; and the American especially so. Consols were a bright exception, in response to gold operations. Friday was very sensitive and variable; but on the whole things looked a shade more promising. Business, however, still continued on a very reduced scale. On Saturday, the better feeling was developed and more assured, as advices received from America reported that the new issues devised to relieve the strain were being responded to in a fair measure, and a moderate recovery in prices was effected pretty well all along the line. In the Money Market, movements almost coincided with those in the Stock Exchange, which to a large extent they animated and controlled. Rates opened easier; then hardened steadily all the middle of the week; giving way again at the close. Business in the Gas Market was quieter, and prices on the whole were weaker, though not all the changes of quotation were downward. In Gaslight and Coke issues, the ordinary continued the advance it was making the week before; and the quotation rose another point. Dealings ranged from 92 on Monday up to 93½ on Saturday. Secured issues were very quiet. The maximum marked 87 and 87¼; the preference from 104⅝ to 102¾ (a fall of 2); and the debenture from 81½ free to 83. South Metropolitan was very quiet also, and changed hands at from 119 free to 119½. The debenture was done at 81¼ and 81½. In Commercials, business was done only in the 4 per cent., which marked 103¾ and 103½. Hardly anything was done in the Suburban and Provincial group. British marked 40¾ and 39 (a fall of ½), West Ham 100 (a fall of 2), and ditto preference 119. Brighton original was put down to the level of the ordinary. The Continental Companies were quiet. Imperial changed hands at 168 to 169½, Union at 113⅜ and 112, European fully-paid at 22½, ditto part-paid at 17⅝, and Malta at 4½. Among undertakings of the remoter world, Hong Kong was done at 19 and 19¼, Melbourne 5 per cent. at 100, Oriental at from 141½ to 139½, Primitiva preference at 4⅞, River Plate at from 12⅞ to 13⅛, and San Paulo at 13¼.

ELECTRIC LIGHTING MEMORANDA.

The Imaginary Vanquishing of Incandescent Gas Lighting by Flame Arcs—The Increase of Flame Arc Lamps—Claimed Advantages and Obvious Disadvantages—Use of Flame Arcs in Fogs and for Interior Lighting—A Loan Refused.

IT is no use struggling any longer. The gas industry has come to the end of its tether. Science abandons it; and its affections are the sole property of the electrical industry. It has already given the electrical industry the flame arc lamp and the metallic filament lamps; and "there is probably something more to come." In words that infer all this speaks the "Electrical Times." Let us make a few extracts from an article (which ought to depress our spirits, but does not) to show how much imagination, fiction, and optimism move the pen of the writer in our contemporary. It is written: "The introduction of flame arcs and the carbons necessary to produce them has rendered it possible to light large spaces at a cost which leaves our gas competitors in despair. Their only refuge—a temporary one (!)—is the medium unit of 300 or 400 candle power produced with high-pressure gas." How dreadful! Where ignorance is bliss 'tis folly to be wise. The knowledge of this instructor in the doings of the gas industry fails him at the moment when, instead of trying to persuade his readers to "rest on their oars, and be thankful," he should warn them to be still up and doing. He has not heard of or seen 3000-candle power high-pressure gas-lamps. However, after this display of ignorance, we look for more of it, and find that he soberly states that it is his belief "the gas people have fired their last cartridge. Gas is sufficiently venerable now to justify one in the conviction that no further improvements comparable with those of Welsbach are to be hoped for." Members of the gas profession will naturally shrink into their shells. The article deals, in the main, with the experimental lighting in Cannon Street; and, of course, "the effect of the present flame arc lamps is excellent. Seated on the top of an omnibus"—that is to say, after being raised midway between ground level and the flame arc lamps—"it is quite possible to read a newspaper without interruption from end to end of the experimental line." We fully believe it. But it is not high up in the air that the light is really wanted; and the ratepayers do not expect to pay for light up there to accommodate people who desire to read on the tops of omnibuses, while on the footways the shadows cast over the faces of pedestrians make it impossible to recognize one's best friend, without very close scrutiny.

There is no question the flame arc is idolized in the electrical industry to day. The old ordinary arc lamp has had its day, and is being defamed right and left. It is neither good for competition nor for illumination. It is wasteful; and its efficiency is low. Nothing too bad can now be said of it by those who fixed their faith on it only a few years ago. "It must be the flame arc, or we shall be beaten out-and-out" cries the station engineer; and the manufacturers have responded. Look through the electrical papers at the advertisements of lamp makers; and flame arc lamps, varying from one another in small detail, are announced under a galaxy of names sufficient to make those interested in the gas industry tremble for their future. The last industrial supplement to the "Electrician" was almost solely devoted to descriptions and editorial references to this brave numerical show of flame arc lamps, about certain of which it was apparent there had been some amount of difficulty in picking out a really distinctive feature. The information, too, upon which the articles were written, it was clear, had been largely supplied by the makers of the lamps; and in noting the points advanced as specially favourable to each lamp, the careful reader will remark that they are, without specifically saying so, regarded as the defects of competing lamps. Well now in this supplement, there are editorial notes which suggest that for factories and such-like places the flame arc should be substituted for the open or enclosed arc lamp. We have noticed before that a great deal of anxiety is being evinced by electricians over the favour that has been extended to high-pressure gas lighting in industrial establishments; and they are pushing the flame arc in competition for all it is worth. But in industrial works, the requirement is a good light produced by the simplest of means; and the flame arc lamp cannot be respected as a simple means of lighting in comparison with an incandescent gas-lamp In the latter, there are no complicated parts to get out of order; in the former, there is mechanism that needs very careful tending, or (apart from the extinctions caused by interruption of current) the lamp will all too soon for the liking of the user be placed *hors de combat*.

"At the present time," too, we read, "the flame arc lamp is the most efficient form of artificial illumination known." That depends on what is meant by "efficient." Judged by the amount of illumination obtained by the expenditure of a given amount of energy, the assertion is true as applied to the various forms of obtaining artificial illumination by electricity. But we must dispute any submission that the flame arc lamp is the most efficient agent extant for illuminating purposes, although we are gravely told that, on "the grounds of economy and intense and pleasing illumination, the flame arc lamp acknowledges no rival, either in the ranks of electric or gas lamps." Though the flame arc lamp "acknowledges no rival," the fact remains that it has a powerful one; and electrical engineers know it, if the flame arc lamp does not. No one denies that flame arcs do show an economy of electricity in contrast with their predecessors for the illumination obtained. To quote examples. A 9-ampere flame arc lamp is stated to consume 360 watts, and is credited with a "mean hemispherical" illuminating power, under working conditions, of 1200 candles; in another case a 7-ampere lamp is stated to use 220 watts, and give a "mean hemispherical" illuminating power of 700 candles; and in yet another case, the consumption is asserted to be 470 watts, and the "mean hemispherical" illuminating power 2342 candles. Imagination goes a long way in these candle powers, though admission must be made that the flame arc lamp has a big illuminating power in its immediate vicinity. But in considering consumptions, the fact that most of these lamps must be used in series, unless voltage is very low indeed, detracts from the claims to economy, especially for shop lighting purposes; for shopkeepers are compelled to go to a great unnecessary capital and running expense for illumination that is much beyond the requisite. In one instance, it is seen that two lamps are required in series on a 100-volt supply; four on a 200-volt supply; and five on a 240-volt supply. Most of the lamps described are arranged for a voltage of about 50 each; so that it follows that the economy of electricity per lamp for the private user is no gain, owing to the compulsory use of more lamps and illumination than is necessary. Supposing a consumer has five lamps in series, using 360 watts each per hour on a 240-volt supply, that will mean the consumption of nearly two units of electricity per hour. It is found that in some forms of lamps a greater illuminating power is obtained on direct than alternating currents.

But economy of electricity per lamp does not cover the whole of the costs attaching to the flame arcs. The carbons are dearer, attendance is heavier, and the wear upon the lamps is greater owing to the fumes and the incrustations on the upper interior parts. In connection with the Carbone lamp, the point is made that "a further advantage attending the use of pure carbons is the low cost compared with the impregnated variety; and this is an important item when considered in connection with the cost of carbons." This confirms the point as to the increased cost of the impregnated carbons and their shorter life than other forms of carbons. In describing one lamp, the "show" is given away as to what the expense of carbons is by the statement that "the cost of carbons in this case is about 0·11d. per lamp-hour, representing a saving of about 0·2d. over ordinary flame arc lamps using larger carbons. It is claimed that this particular saving, if spread over

a year's burning of (say) 3000 hours, reaches the respectable sum of £2 10s. per lamp." After reading the editorial commendation of the flame arc lamps, it strikes us as peculiar that one of the descriptive articles appearing later should start with the words: "The principal drawbacks of flame arc lamps are the rapidity with which the carbons are consumed, and the short life which the lamp accordingly has." There is truth in the words. Even the uninitiated in the organic structure of flame arc lamps will recognize by examining the sectional illustrations in our contemporary how much these lamps are exposed to disorder through the number of working parts. Labour for replenishing with carbons, as distinct from the labour for cleaning, has been reduced, in the "Oriflamme" lamp, by the introduction of a carbon magazine; but as this is the only magazine lamp on the market, it does not appear that the magazine is looked upon with any great favour. In fact, the additional parts thus introduced into the lamp cannot be an undisputed blessing to the user. However, if the magazine lamps do not give any intermediate trouble, they will run for 36 to 40 hours without attention.

With reference to the use of the flame arc lamp for street lighting, we have had something to say on previous occasions. But the recent heavy fogs have given an opportunity of judging of their value under the worst conditions of use. They are somewhat better under such conditions than the open or enclosed types of arc lamps, but not much. The "Electrical Times" publishes a photograph of the appearance of the light in Cannon Street during a dense fog, which shows their lack of penetrating power through the thick, murky atmosphere. About the lighted lamps, there is a clean spherical cut, and they wear a "dim-and-distant" aspect. We hope that the illustration will have a big circulation among street lighting authorities. The "Electrician" advocates the use of flame arc lamps for the interior lighting of shops and workrooms. We pray that the advocacy may cease, or that the "Electrician" will for ever hold its peace as to the assumed contaminating influence of incandescent gas-lamps. Let us use a few extracts from our contemporary's own descriptions of the flame arc lamps, and allow them to stand as comment on the advocacy of this type of lamp for interior use. In the case of one lamp "as an abundance of air is supplied to the arc during burning, the products of combustion are almost completely consumed." Then, again, we read that "to ensure satisfactory burning, the gases and vapours produced by the arc must be prevented from depositing on the globe interior; otherwise much light would be cut off during the later burning hours." Those gases and vapours have to go somewhere. Further "we have been shown lamps heavily coated with deposits which seemed to run quite satisfactorily, though in an apparently dirty condition." In another lamp, "special arrangements are made to remove the gases from the globe as soon as they are formed"—that is to say, they are hurried away into the atmosphere. And these are the lamps that it is suggested shall be brought into competition with incandescent gas-lamps in shops and workrooms. One other point, in reference to the question of the injurious effect of these gases and vapours on the mechanism of the lamps. The use of pure carbons in the "Carbone" lamp, as distinguished from the impregnated variety, is claimed as "a safeguard to the mechanism from corrosion," and as a relief from "the risk of *rapid* destruction" of the working parts.

Touching, too, on interior lighting, the intelligence is given, in one of the descriptive articles, that "incandescent gas lighting is a dismal failure when applied to church lighting. The ghoulish glare converts the appearance of the building from one suggestive of sanctity to the resemblance of an ordinary hall or business mart." While places of worship are being fitted up daily with incandescent gas-burners, we will merely quote and smile at such a display of puerility and of dishonest description. The statement is made in connection with an account of the installation of flame arcs in St. Andrew's Church, Sunderland; and it would be interesting to know whether the place in consequence bears "any resemblance to an ordinary hall or business mart," or whether the worshippers are reminded of the exterior illumination lately adopted by some of our public-houses? We notice that—though these are flame arc lamps—recourse has been had to reflectors to obtain a *good diffusion* of the light to *eliminate shadows*, and to screen the source of illumination from the eyes of the congregation."

It has been a matter of remark in the "Memoranda" that the Local Government Board are still doing their best to bring about sound financing in connection with municipal electricity undertakings. But no matter what they have done in the past in certain cases, the warning has not been heeded by other authorities. The Board are, therefore, compelled to take even more stringent measures than hitherto. An example has been made of the Newport (Mon.) Corporation. They applied months since for a loan for electricity extension purposes; and the Inspector's investigation at the local inquiry was of a minute character. He found among other things an adverse balance on revenue account of nearly £3000; and the Board have now given notice to the Corporation that they cannot entertain a further loan on capital until this adverse balance has been dealt with. To wipe off the balance will require a 2¼d. rate. And this is not the only charge brought by the electricity undertaking on the ratepayers, for the department receives some £3000 per annum for electric lighting in the borough which the Gas Company could do by incandescent gas-lamps for less than half the money. The gas bill for public lighting in Newport, we believe, only amounts to £3200, for which more than three-fourths of the town is lighted against less than one-fourth by electricity. Official complacency over the condition of the undertaking at Newport (Mon.) has been rudely disturbed by the decision of the Local Government Board; and the local Members of Parliament are to be asked to intercede with the President of the Board.

PERSONAL.

Mr. A. B. PILLING, the Clerk of the Metropolitan Water Board, has been elected President of the Chartered Institute of Secretaries for the year 1907-8.

At the weekly "Men's Own" at the Ipswich Social Settlement on Sunday, the 17th inst., an illuminated address, subscribed for in amounts of one penny only, was presented to Sir DANIEL GODDARD, M.P., as an expression of the contributors' pleasure at the honour recently conferred upon him by His Majesty the King, and of the hope that he would be spared for many years to carry on at the Settlement his self-denying labours for "God and the people." The presentation was made by Mr. R. T. Parker, who said the subscribers were all heart to heart in the pleasure they experienced at the bestowal of a title on one who deserved it, if any man did. The establishment of the Settlement was a mighty expression of his love for his fellow-men; and it would take eternity to tell all the good that had been done there. On rising to reply, Sir Daniel was received with prolonged applause. He said he greatly appreciated the kindly expressions employed in the address in regard to himself and to the little service he had been permitted to render to his town and fellow-townsmen; and he thanked the donors from his heart. He had had bestowed upon him a title; but he hoped the men of Ipswich would always find that behind it there lived the same man that they had always known. He had only one great desire in living his life there, and it was, not that he should be known by a title or by any such thing, but that when the time came for him to lay down his life, he should leave the memory of having been a brotherly man and a friend of the people.

At the meeting of the General Purposes Committee of the Birmingham City Council on Monday last week, the Lord Mayor announced that he had received the resignation, on account of ill-health, of Mr. E. ORFORD SMITH, the Town Clerk. Mr. Smith sustained a severe nervous breakdown some time ago; and though, after a long holiday, he recovered to some extent, it was obvious that his retirement from his official position was a matter which could not long be delayed. In the early part of September he had a serious relapse, and recently he has been in care of a specialist. Mr. Smith was appointed Town Clerk in 1881, on the death of Mr. E. J. Hayes. He is by profession a Solicitor, and in the early days of his career had charge of some important parliamentary practice in the firm of Messrs. Fearon and Clabon, of Westminster. He subsequently took charge of the Solihull branch of a London firm into which he had entered as a partner, and to which he eventually succeeded. In 1880 he went to London, and entered into partnership with his brother-in-law (Mr. T. D. Bolton); but when the position of Town Clerk of Birmingham became vacant, Mr. Smith applied for it, and was unanimously chosen from a large number of competitors to fill it. His extensive knowledge of everything pertaining to the intricacies of local government and parliamentary procedure has been of the utmost value. He was the author of the Consolidation Act of 1883, by which the Local Acts were codified and amended, and about twenty statutes reduced to one. He took an active part in the extension of the borough boundaries by which Saltley, Nechells, Balsall Heath, and Harborne were included; and it was his suggestion that led to Birmingham being created a city in commemoration of the Jubilee of the Corporation. He necessarily had a most important part to play in the arrangements for the promotion of the Bill for obtaining a supply of water from Wales, more especially in the various questions of legal rights in connection with the acquisition of the gathering-ground of the Elan and Claerwen watersheds, and the facilities for the construction of the conduit. Apart from his strictly official duties, he has always taken a keen interest in municipal government generally, and has been an acknowledged authority on the subject. He has rendered active service on the Council of the Association of Municipal Corporations and on the Law Committee of that body. He was prominent in the promotion of a Committee of County Boroughs for the protection of their special interests under the Local Government Act of 1888; and in 1893-4, he had the distinction of serving on the Royal Commission on the Government of London, upon whose report the new Municipalities for the Metropolis were constituted. He was also a member of a further Royal Commission appointed to inquire and report upon the subject of local taxation, and whose sittings lasted from 1896 till 1902; and he gave evidence before important Parliamentary Committees, notably one appointed in 1886 upon the Electric Lighting Bills of that year. At the time of his appointment as Town Clerk, Mr. Smith was a Liberal in politics; but after taking office, he made it a rule not to attend political meetings unless accompanying the Chief Magistrate in his official capacity. He has always been urbane and courteous; and his resignation, which will be formally communicated to the Council at their meeting next month, has consequently been received with great regret.

GAS UNDERTAKINGS AND FOG.

[COMMUNICATED.]

THE season of fog has descended upon us; and days of anxiety are approaching the manager who is not over-blessed with storage accommodation. It speaks volumes for the foresight and careful management of responsible officials that a failure of gas supply is so rare an event. The densest fogs are generally confined to the large cities and towns; and it is in these populous districts that the responsibility is so great. The failure of the gas supply in one of the districts of the London and Suburban Companies, or in any of the large towns, would be so serious that anything to prevent its possibility must be a subject well worthy of some discussion.

An arrangement whereby each undertaking had a connection, duly provided with a meter and valve, with its next-door neighbour or neighbours, would constitute itself a safeguard of inestimable value, not only in the case of a prolonged period of fogs, but also to provide against emergencies which are at other times within the range of possibility. It is unnecessary to give specific instances; but several will occur to those familiar with the precautions which it is necessary to take to provide against emergencies. Fogs, even in our climate, are not prolonged for an indefinite time; and the probability is that in the case of a failure a comparatively small quantity of gas would be sufficient to tide over what would be merely a temporary difficulty. Foggy weather has a way of placing all gas-works in a similar plight; and difficulty would possibly be experienced in persuading a neighbouring undertaking to hand over what they themselves might sorely need at a later period.

A wise concern will consider money spent in keeping retort-settings and water-gas plant in readiness for exceptional demands as a prudent means of insurance against emergencies which may come just when least expected. Additional and extraneous precautions would, however, render the position of each individual undertaking doubly secure. Difficulty in carrying out an arrangement which would admittedly give increased security against the dire consequences of a failure of gas supply is no reason why the subject should not be brought up for consideration; and it is thought that, in spite of obvious difficulties, a solution may be found which would enable the suggestion to be carried into effect.

LOCAL GOVERNMENT AUDIT.

OPINION is very much divided as to the value of the Local Government Board audit of municipal accounts. In many towns, the overburdened ratepayers occasionally cry out for it, in the hope that it will afford some relief from their troubles; while among the Progressives and supporters of municipalization generally it is condemned as a pedantic restraint on local freedom. One of the few provincial towns upon which this form of audit has been imposed is Plymouth; and its experience is not without interest as an illustration of the effect which it has upon affairs.

Last week, the Auditor summoned a number of councillors and former councillors before him, to show cause why they should not be surcharged in a number of small amounts for which they had signed cheques. So far as this part of the proceedings of the Auditor went, it cannot be said to hold out much hope of an effectual relief of ratepayers' burdens. One of the payments objected to was a sum of £50 given by the Town Council to the parents of a child who was killed in one of the Council's schools. As the Town Clerk explained, the Corporation's legal liability for the unfortunate occurrence was doubtful; but it was a case in which a jury would probably have found against the Corporation, and it was cheaper to settle than run the risk of litigation. If, said the Town Clerk, his discretion as to when it was wise and politic to settle claims was to be fettered by saying that they must fight every doubtful case, the Corporation would be involved in a very great amount of litigation. Apparently the Auditor saw the truth of this; and the payment was allowed. In another matter which causes a good deal of controversy in many towns, the Government Auditor's interference at Plymouth has led to a modification of the Council's procedure. Hitherto it has been the custom to allow members of the Council a guinea-and-a-half a day, in addition to travelling expenses, when engaged on deputations. The Auditor objected to a great number of the sums paid under this head, both to councillors and to officials. Certain expenses were incurred in connection with meetings of different Associations and Institutions that representatives of the Corporation attend. The Mayor contended that the Council had a right to send their officers to these meetings, if they chose to do so, and said that if he were surcharged for having signed cheques for this purpose, he should pay, though he thought it a monstrous injustice he should have to do so. Other members did not take the matter in the same way. One of them said that if he were surcharged he would fight the case in the Courts, because he considered it an intolerant interference with the government of the town. Another spoke of the whole proceedings as "an annual farce." The final result of the discussion was a statement by the Auditor that, in view of a decision of the Council to reduce the allowance to a guinea a day in future, the former payments would this year be permitted to stand. It will, no doubt, please some people to see the expenses of these deputations reduced. But, as the Town Clerk remarked, it is one of the smallest subjects that public bodies are concerned with, though it frequently causes more controversy than things of far greater consequence.

So far as Plymouth's experience goes, the Local Government Board audit would seem to be of little effect in the direction of preventing the heavy expenditure and excessive borrowing which are the cause of high rates. In checking waste on little things, it is no doubt beneficial.

DIRECT AND INDIRECT LIGHTING METHODS.

THE physical attribute of intrinsic brilliancy per unit of surface has probably had a considerable, and perhaps unsuspected, effect upon the way in which lighting problems have been attacked where gas and electricity have respectively been concerned. Putting aside for the moment the question of the nature of the illumination, some little discussion has, during the last year or two, taken place as to the relative merits of direct and indirect lighting. Indirect illumination would perhaps be little heard of but for the existence of electric lighting, and probably not at all were it not for the high intrinsic brilliancy of certain forms of lamps.

The trying and fatiguing character of concentrated light is felt by many people; and their inevitable complaint necessarily drives all those who are dealing in lamps of great intrinsic brilliancy to a full consideration of ways and means to overcome the difficulty. The solution may be of two or three kinds—one to heavily shade the luminous source, another to keep it considerably above the line of vision, a third to place it out of sight altogether. The fact that electric lamps can without any great detriment be fixed close to the ceiling obviously helps many electricians to think favourably of the last-named methods—especially as the phenomena of multiple reflection tends to equalize the illumination effect. Not only, therefore, are schemes of ceiling lighting more frequent, but indirect lighting is advocated by some lighting practitioners as being hygienically superior, more pleasing in some respects, and generally approximating to diffused daylight. These advocates are principally of the electrical persuasion.

There undoubtedly are places where indirect lighting is of considerable service. Drawing offices, reception rooms, and schools are examples. In the great majority of cases, however, diffused illumination is not necessary, and is indeed inadvisable. This is fortunate, since indirect lighting is costly and difficult to apply; it entails a liberal use of light and special care of the reflecting ceiling and wall surfaces. Direct lighting methods, on the other hand, are inexpensive; they procure a certain amount of contrasted light and shade, which enhance, if anything, the æsthetic effect of one's surroundings, and with certain work materially help in its easy execution. They also derive some little advantage from wall reflection, which therefore is not peculiarly the property of the indirect system.

It has been said that satisfactory and pleasing lighting is afforded by a general and moderate illumination derived by the indirect method, superimposed by a strong local illumination. This is practically the same effect as that obtained by means of good overhead lights, the illumination effect of which is aided by wall reflection; and the latter is certainly less expensive in attainment. Such a system is that generally in vogue in gas lighting practice; and in that it is, or can be made, satisfactory, the gas engineer is fortunate, since the nature of his illuminant precludes close proximity to the ceiling, unless some special device is adopted. It has time after time been pointed out that the intrinsic brilliancy per unit of surface in the case of the incandescent gas-burner is much lower than that of the ordinary electric lamp; hence the necessity of indirect lighting is not imperative, even if it were not distinctly disadvantageous. There could not be in the minds of most much doubt that diffused illumination methods would prove very costly, because of their relative inefficiency; but the extent of the latter defect is probably seldom fully realized. In this connection therefore some interest will be found in the paper contributed by Mr. Preston S. Millar to the Illuminating Engineering Society, on the "Elements of Inefficiency in Diffused Lighting Systems."

Reduced intrinsic brilliancy and uniform distribution of light are obtained in indirect lighting methods by the sacrifice of efficiency in various respects, and these are severally dealt with in the paper. The first element of inefficiency is the loss of a large proportion of the light in multiple diffuse reflection; and this is proved by Mr. Millar by some figures of experimental lighting under both the direct and the indirect systems, carried on in the same room and under the same conditions. Mr. Millar states that a room, measuring 16 ft. by 11 ft. by 12 ft. 6 in. high, with white walls and a light buff ceiling, was employed for the test. The lighting was achieved by a central pendant 9 ft. 6 in. above the floor, and so arranged that a group of twelve suspended incandescent electric lamps with "Holophane" reflectors was used for direct lighting, and another group of 24 bare electric lamps served for indirect lighting. In the latter case, the whole of the light was directed towards the ceiling or the walls; the lamps being inverted and shaded from the floor. In making the test, a sufficient number of the lamps were burned in each installation to afford satisfactory illumination for reading. The tests

for illumination were made on the horizontal plane 30 inches above the floor. The results of the two tests are given below :—

	Direct System.		Diffused System.
Square feet of floor space	176	..	176
Number of lamps	4	..	24
Average mean horizontal candle power	10·2	..	19·4
Average watts per mean horizontal candle power	3·53	..	5·16
Total watts	145	..	2398
Horizontal illumination—average foot candles	1·02	..	3·29
Foot candles per watt per square foot	1·24	..	0·24
Relative effect of installation as a whole $\frac{\text{Diffused}}{\text{Direct}}$ = 19 per cent.			

It will be inferred from the large number of lamps used in the diffused system that the ceiling was brilliantly illuminated in order to obtain adequate lighting on the horizontal plane above the floor—in other words, excessively high initial candle powers were necessary to achieve the end in view.

Mr. Millar then proceeds to deal with efficiency so far as concerns the light actually utilized—that is, the proportion of the total flux of light which is effective on the plane considered. He recasts the table already given for this purpose, and gets the following figures :—

	Direct System.		Diffused System.
Total flux of light, lumens	424	..	4824
Flux on working plane, lumens	180	..	579
Efficiency of light utilization, per cent	42·3	..	12
Efficiency of illuminants (burners per watt)	2·92	..	2·01
Relative efficiency of systems $\frac{\text{Diffused}}{\text{Direct}}$	28 per cent.		
Sacrificed to secure diffusion	72	,,	

[Note: In the above table, "lumens" is taken to indicate the unit of light flux distributed through unit solid angle, and given by Mr. Millar as the mean spherical candle power × 4 π.]

If the horizontal plane is made the sole criterion, it appears that the efficiency of the diffused system in the test installation was only 28 per cent. of that of the direct system; this figure being independent of the efficiency of the lamps installed, and therefore offering the correct basis of comparison. This is a striking indictment against indirect lighting methods. But not content with this, Mr. Millar proceeds to instance other factors which make for inefficiency with this system. It will be probably sufficient to briefly allude to these, since they are to a great extent obvious. On economic grounds the loss due to unnecessary intensity at unimportant points becomes a distinct disadvantage; and it is pointed out that efficiency is gained by permitting the intensity to approach a minimum at points where the high intensity is neither required nor desired. This consideration necessarily affects the above-quoted figures, which were on the basis of averages of the whole working surface illuminated.

Mr. Millar gives as a third factor of inefficiency the ineffectiveness of those rays which, in the indirect system, fall at small inclinations upon the surface to be illuminated. It is a question, however, for Mr. Millar as to whether this loss was not already taken into account when he made the illumination effect tests. Another factor is stated to be the necessity for higher intensity in lighting units; but the cost—or, as it may be called, the waste—must obviously have entered to some extent into computation in making the deductions from the tests referred to. A point is gained, however, when Mr. Millar says that brilliantly illuminated ceiling and walls cause the working plane to appear by contrast dimly lighted. We all know from experience that this is so; and we further realize that the amount of illumination really required on our work is influenced very considerably by the nature of the surroundings. It is exceedingly interesting therefore to note Mr. Millar's investigations on this subject.

In the test installations, the experimenter had a particularly flexible system, in that he could in direct lighting vary the units in use from one to twelve lamps, and in indirect illumination from one to twenty-four lamps. Ten individuals were asked to select their own positions for easy and comfortable newspaper reading—first under direct, then under indirect illumination. In each instance the lighting was varied until the particular individual had to his taste obtained satisfaction and comfort in reading; and then the newspaper was removed and the illumination intensity at the same point and angle measured. In practically every case, the reader required for reading purposes a greater foot-candle illumination under the diffused lighting system. The average illumination was 2·7 foot-candles in the case of direct, and 4·45 foot-candles in that of indirect lighting—a difference of 65 per cent. This would appear to strongly corroborate the suggestion that contrast, or a certain amount of light and shade, is advisable in illumination. With direct lighting and relatively dark walls, the pupillary action of the eye is so influenced that a low intensity of illumination is sufficient—and, it might be added, less fatiguing.

Summing up, Mr. Millar concludes that in diffused lighting systems of the class considered, where the illumination of the working plane is one of the prime objects, a large proportion of the light is lost; that which is not lost becomes less effective; brilliant illumination is produced where it is useless and even undesirable; and conditions are established which create a demand for an unduly high intensity of illumination on objects viewed.

The figures given by Mr. Millar, of course, only apply to his own test conditions; but in view of light buff ceiling and white walls, they are favourable to the diffused system. The full value of the reflecting surfaces might, under ordinary circumstances, easily be discounted by coloured or even dirty walls. The effects quoted, however, are, as Mr. Millar says, present in varying degree in all systems in which control of any large proportion of the light is lost.

The experimental work covered by the paper indirectly shows that there are practically no disadvantages from the use of direct lighting systems; and on the score of economy, there is considerable gain.

LONDON'S WATER SUPPLY IN 1847.

A RETROSPECT.

By George Kebbell.

The water supply of London in the late forties would appear to have become the subject of pretty general discussion, and various measures culminating with the Water-Works Clauses Act of 1847 were from time to time before Parliament. One proposal which seems to have obtained considerable support was a measure giving the power of supply to the Vestries. Various causes had led to the subject becoming one of the gravest questions of the day. One most serious cause of complaint was the impurity of the water supplied; while another was the charges levied by the Companies, the whole of whom in one day agreed to raise, and did raise, their prices 15 per cent. Prior to the Act of 1847, the consumer would appear to have been at the mercy of the Company supplying him as regards the sum to be paid for water. The various statutes conferred on the Companies power to construct works and serve certain specified areas, but did not give the public the right to demand and receive a supply. The consequence was that a Water Company were in much the same position as a tradesman, and could refuse a supply altogether, or only furnish it on their own terms.

London was beginning to grow rapidly, even in those days; and it was felt that the position of the inhabitants must be placed upon a sounder and more definite basis. Various standards had been adopted by the Water Companies for assessing the premises supplied; one plan (not a bad one) being to charge so much a room. However, the nearly universal opinion seems to have been that the rate should be levied upon the basis of "annual value;" and these were the words finally introduced into the Act of 1847. But that the Legislature intended these words to receive the construction the Companies placed upon them until stopped by the decision of the House of Lords in the Dobbs case, is very doubtful. That the intention was that the poor-rate value should be the standard, even then, seems clear, for it was constantly mentioned during discussions in the House of Commons. It is most unfortunate that the Act, while defining many other, and comparatively unimportant, terms and expressions, placed no interpretation upon the words "annual value," with the consequence that the omission cost the public some millions of pounds which went into the pockets of the shareholders. It was thirty-six years before the Dobbs case decided that all this time the Companies had been obtaining their water-rates on the gross instead of the net rental value of the premises supplied—roughly, 20 per cent. more than they were entitled to, as decided by the above-mentioned case. But, over and above all this, it is doubtful if, in fixing "annual value" as the standard, the Legislature took into account the possibility of the enormous increase which has since taken place in such value. In 1847, the highest rateable value in London was £153 (in Hanover Square), and the lowest £9 (in Bethnal Green). The average rateable value in that year was £46 on the north side of the Thames and £25 on the south side, which was then very little built upon. The population in the former area was 52 to the square mile, and in the latter 14. The poor-rate was 1s. in the pound on the north side of the Thames, and 1s. 6d. in the pound on the south side. Happy times!

The matter which caused the greatest interest, or rather consternation, was the evidence of the impurity of the water. Of course, it must be remembered that probably less than half the population took their supply from the Companies. Every house, or nearly every house, had its pump; and, besides, each district had a public pump (generally placed in a Churchyard), from which many of the inhabitants took their supply. Only three of the Companies filtered their water—namely, the Grand Junction, the Chelsea, and the Southwark—although, in the strict sense of the word, these Companies cannot be said to have filtered, for all they did was to allow the water to remain in what were termed "deposit reservoirs" for a few days, until the solid matter had sunk to the bottom. In the same way the consumer used a cistern, not to store his water, but so that it might settle before he used it. It seems at the present day scarcely credible, but it is a fact that at this time the Lambeth Company drew the whole of their supply from the Thames between Waterloo and Hungerford Bridges; and, except that the water was allowed to settle, they furnished it to their customers just as they took it from the river. It must be remembered that the Thames was then receiving the sewage of London; and the water is described as having the appearance of broth. It was only in the Lambeth Company's Act of 1848 that they were required to filter their water. Probably what alarmed London most of all was the out-

break of cholera during the late forties. So bad was the water of the Thames at the time, that there is authentic evidence of a ship taking some of it to sea, and when the bung was withdrawn from the cask containing it, and a light inadvertently held to the bunghole, the gases arising from the water caught light. An expert of the time described this phenomenon by saying it was "owing to decomposition of organic matter." The Royal Mint and the houses in the neighbourhood obtained their supply (in part) from the Tower Moat, the water in which, however, soon after became so offensive that it was drawn off.

There were at the time several schemes before Parliament for supplying London with water. One proposed to bring it from Bala Lake in North Wales (a distance of 200 miles), and another from Watford; but the Bill was thrown out on the second reading. The Grand Junction would appear to have been the most advanced of the Water Companies. They had, until some few years previously, obtained their supply from the River Colne by means of the river which is now called the Grand Junction Canal. In 1848 they attempted what was intended as a constant supply —doubtless the first experiment of the kind ever made. But it seems that during the year ending Sept. 30, 1849, there were in different parts of their area 2316 interruptions of the service, varying from half-an-hour to six hours each. This was a primitive notion of "constant" supply.

There is no mention in the Act of 1847 of any charge to be made by a Company except the percentage on the annual value of the premises supplied, and certainly nothing is said as to high service. Yet from the discussions in Parliament it is clear it was thought high service would be given without any extra charge. An extraordinary omission from the General Act of 1847, and, in fact, from every Water Act that has been passed, is a definition of the word "domestic." It is scarcely possible that this omission has been intentional; yet most of the Private Acts do declare certain supplies as not domestic. The neglect to interpret the word has led to an enormous amount of litigation. Most of the Companies obtained Private Acts within four or five years of the passing of the 1847 Act; and they all succeeded in getting powers to make additional charges for baths and water-closets—that is to say, additional to the charge for what the Acts all term "domestic" supply. No artificial meaning having been placed by the statutes upon the word "domestic," it should, it is contended, be construed in its natural sense. What could be more "domestic" than a bath or a water closet?

Certain of the old Acts contained barbaric provisions. For instance, one passed a hundred years ago provided that anyone damaging a water company's works should be liable to seven years' transportation; but for the same offence he is now, under the Act of 1847, simply liable to a fine not exceeding £5. There is another, and far more serious, way in which a water authority's works may be interfered with, for which, clearly by an oversight in the Act of 1847, no punishment is provided. In the interests of water authorities and the public generally, it may be as well not to further explain. There is in the same Act a most important section which, owing to a printer's error in one word, has remained inoperative. Probably no Act of greater importance and utility, or with wiser provisions, has ever been passed; and probably no Act was ever more loosely drawn.

It is interesting to note, in some of the very old Water Companies' Acts, that the undertaking is promoted from philanthropic motives—that is to say, for providing water for the extinguishing of fires, and so forth. It may have been so, of course. Many philanthropists see 40 per cent. for their money. One of these Companies started with £60,000 of capital, and a few years ago they made a revenue of nearly £400,000. This seems enormous; but then it must be borne in mind that the original enterprisers never saw any return whatever for their money, while, if an average were taken of the whole of the dividends paid during the Company's existence, it would not amount to more than about 2½ per cent., because for many years in succession no dividend whatever was earned. There is a good deal to be said for the old Water Companies, even on the question of philanthropy. Sir Hugh Myddelton reaped absolutely no pecuniary benefit whatever from his scheme; and he died nearly broken hearted at his treatment. In sore straits to complete his venture, he applied to the Corporation of London for assistance; but while expressing great friendship, they laughed him to scorn, telling him that his scheme was a mad one. When, years after, by the aid of King James, the undertaking was successfully completed, they went in state to the New River Head at Pentonville, and formally opened it. Sir Hugh was not the only man who has had cause to say, "God save me from my friends."

WATER ACTS FOR 1907.

THIRD ARTICLE.

THE Metropolitan Water Board (Charges) Act provides for uniform scales of charges for water applicable throughout the limits of the Board. For the purposes of the Act, section 72 of the Water-Works Clauses Act, 1847, is to be read and have effect as if the words "rateable value" had been inserted therein instead of the words "annual value," and "twenty pounds" instead of "ten pounds." In order to make uniform throughout their limits the obligations of the Board with respect to the supply of water, section 35 of the Act of 1847, relating to the keeping of a constant service of water at high pressure for domestic purposes, and certain sections of the Acts of the late Water Companies, are to be repealed to the extent specified in a schedule to the Act. The 8th section sets forth that the Board are to furnish, at the request of the owner or occupier of any house or building, or any part of one, occupied as a separate tenement, a supply of water for domestic purposes at a rate per annum not exceeding 5 per cent. of the rateable value of the house or part of a house in respect of which the supply is required; and, subject to the provisions of the Act, this rate is to be charged uniformly, under like circumstances, to all consumers entitled to a supply. Rebates are, however, to be made in certain specified cases. The rateable value is to be determined by the valuation list in force at the commencement of the quarter for which the rate accrues, or, in the absence of such list, by the last rate made for the relief of the poor. Notwithstanding anything contained in section 70 of the Act of 1847, the quarterly days for the payment of the rates are to be the first days of April, July, October, and January in each year. On being requested so to do, the Board are to supply water by measure for other than domestic purposes, at rates ranging from 11d. down to 6½d. per 1000 gallons according to the quarterly consumption. These rates are to be charged uniformly, under like circumstances, to all consumers entitled to receive a supply of water under the section; and the Board are to be exempt from penalty for not supplying it, if the failure arises from frost, unusual drought, or other unavoidable cause or accident. Special provision is made for the supply of water for building purposes. The meter-rents range from 1s. 6d. to 25s. per quarter, according as the diameter of the inlet and outlet does not exceed ⅜ inch or 8 inches. No extra charge is to be made in future for high service. By section 25, the expression "domestic purposes" is defined as including water-closets and also baths so constructed or fitted as not to be capable of containing when filled, or filled up to the overflow or waste pipe (if any), more than 80 gallons, compared with 50 gallons in the Bill; but it does not include a number of purposes which are clearly specified—washing carriages, watering gardens, and fire extinction being among them. Provision is made for the payment of water-rates by owners of small houses; and the Board are empowered to compound rates. The charge for water for public purposes is to be at the rate of 6d. per 1000 gallons. Water-rates are to be recoverable by action. The Metropolis Water Act, 1902, is amended in certain respects. The Act comes into operation on April 1, 1908. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Metropolitan Water Board (Various Powers) Act authorizes the Board to construct water-works, acquire lands, and carry out other objects. The works comprise a tunnel under the Thames, commencing at Twickenham and terminating at Richmond, a number of conduits or pipe-lines, and a reservoir adjoining the present one belonging to the Board at Croydon. The Board are empowered to connect these works with those already existing, lay mains beyond the limits of supply, alter the position of their mains and pipes, and underpin houses where necessary. The period for the completion of the works specified is seven years from the passing of the Act; and an extension for a like period is granted in respect of a reservoir and a conduit or pipe-line authorized by the Lambeth Water-Works Act, 1900. Powers conferred by the Southwark and Vauxhall Water Act, 1898, for the construction and completion of a pumping-station at Walton-on-Thames, and a conduit or pipe-line in connection therewith, are revived and continued for a period of three years. The Act contains a scheme for the establishment of a superannuation and provident fund. Among the numerous miscellaneous provisions are some authorizing the Board to deviate from the limits specified for the Lambeth reservoir; execute works on lands at Long Ditton, Enfield, and Westerham; establish communication with the works by means of electricity; and alter pipes, wires, &c., under streets. The Board seek power to borrow £187,436 for the purchase of land and the execution of works authorized by the Act; £350,000 for those for which an extension of time is allowed; £100,000 for the Long Ditton, Enfield, and Westerham works; the amount necessary for defraying the expenses of the Act; and, with the sanction of the Local Government Board, such further sum as may be required. For the three amounts specified, fifty years are granted in which to repay them; for the costs of the Act, five years; and for the further amount, such period as the Local Government Board may determine. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The St. Neot's Urban District Council Act authorizes the Council to acquire the undertaking of the St. Neot's Water Company, and supply water throughout their district and the neighbourhood; and it confirms an agreement entered into between the Liquidator of the Company and the Council for the sale of the concern for the sum of £9000. The Council are empowered to make additions to the works. The charge for water is based upon the rateable value of the premises supplied, with the addition of a sum not exceeding 5s. per annum for every closet beyond the first, and a maximum of 7s. 6d. per annum for every fixed bath capable of containing not more than 50 gallons. Authority is given for borrowing the amount necessary for the completion of the purchase, £3000 for the extension and improvement of the undertaking, the money requisite for defraying the costs of the Act, and any further amount the Local Government Board may sanction. The purchase-money and incidental expenses are to be repaid within forty years; the money borrowed for extensions

within thirty years (being respectively ten and twenty years less than was asked in the Bill); five years are allowed for liquidating the expenses of the Act; and any sum raised with the sanction of the Local Government Board is to be paid off within such period, not exceeding sixty years, as they may prescribe. Separate accounts of the water-works undertaking are to be kept. [*Parliamentary Agents: Messrs. Warwick Webb and Co.*]

The Act of the Sheffield Corporation confers upon them power to construct two aqueducts or pipe-lines terminating in the existing Underbank reservoir, which are to be completed within seven years from the commencement of the Act; also to make agreements with millowners in regard to the quantity of compensation water to be discharged into the Rivers Rivelin and Loxley. The Corporation Water Act of 1896 is amended with respect to compensation water. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Southport, Birkdale, and West Lancashire Water Board Act authorizes the Board to purchase certain water-works at Scarth Hill from the Skelmersdale Urban District Council for the sum of £22,500. The amount required for the purpose, with the incidental expenses, is sanctioned, as well as a sum of £1736 for connecting the acquired works with those of the Board, £1000 for improvements, and whatever may be necessary for defraying the taxed costs of the Act. The first three amounts are to be repaid within thirty-five years from the date of borrowing; and the last within five years after the passing of the Act. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Tees Valley Water Act is to consolidate, with amendments and additions, the provisions of the various Acts relating to the Tees Valley Water Board. The first portion deals with the constitution of the Board, and defines the periods for which the members are to remain in office. The Board are empowered to complete the construction of the Grassholm reservoir and other works sanctioned by the Acts of 1876 and 1890, notwithstanding the repeal of these Acts; and they are granted until Dec. 31, 1914, for doing so. The Act contains provisions preserving the rights of the Board to take water from rivers, defining the quantity to be returned to them by way of compensation, and specifying the penalty incurred in case of failure or of excess abstraction. The Board may sell portions of the undertaking to the Council of any urban or rural district within the limits of supply, and beyond the boundaries of Stockton, Middlesbrough, and Thornaby-on-Tees; and also for the supply of water in bulk under specified conditions. The charges for water for domestic use are to be based on the annual value of the premises supplied, with extras for closets and baths; but beyond the above-named boroughs they may be one-fourth more than they are within. In the case of water supplied by measure, the charge is not to exceed 1s. 4d. per 1000 gallons inside and 1s. 8d. outside the boroughs. The financial provisions of the Act include power to the three Corporations constituting the Board to borrow the amounts named for the various purposes specified; and the periods for repayment are all defined. [*Parliamentary Agents: Messrs. Wyatt and Co.*]

The Tynemouth Corporation Act is to authorize the Corporation to construct additional water-works and raise more money. The works comprise two covered and two service reservoirs and several pipe-lines; and they are to be completed within ten years after the passing of the Act. The Corporation are authorized to borrow for the completion of works sanctioned by their Water Act of 1898 (the time for which is extended from ten to fifteen years) £100,000; and for making an approach road to the Font reservoir, £2000—both amounts to be repaid within sixty years from the date of borrowing. For carrying out the new works now authorized, they may borrow £62,500, and, with the sanction of the Local Government Board, a maximum of £50,000 for the effectual execution of the powers of the Act of 1898 and of the Act just obtained. Sixty years are granted for the repayment of the loans, except such as may be incurred to defray the expenses of the Act, which are to be repaid in five years after the date of the Royal Assent. [*Parliamentary Agents: Messrs. Durnford and Co.*]

When noticing the Bills promoted by Companies (*ante*, p. 480), it should have been mentioned that the Newquay and District Water Company have obtained an Act sanctioning an extension of their limits of supply, and authorizing the construction of additional works and the raising of more money. The area now comprises the urban district of Newquay and the parishes of St. Columb Major, Colan, and St. Columb Minor Rural, all in the county of Cornwall. The existing works are fully described in the Act; and those authorized consist of two wells and pumping-stations, two headings, a covered reservoir, and eight pipe-lines, to be completed, as regards specified portions, within five years, and as to other portions within seven years, from the passing of the Act. The charges for water for domestic purposes are to be based upon the gross estimated rental of the premises supplied; with a minimum price of 8s. 8d., and a period of twelve months. Closets after the first and fixed baths are to be extras. The charge for supplies by meter is not to exceed 1s. 6d. per 1000 gallons. Authority is given to raise additional capital to an amount not exceeding £38,000, to carry 7 per cent. dividend if issued as ordinary, and 5 per cent. if as preference capital. Borrowing powers to the extent of one-third are granted in respect of the existing as well as of the additional capital—the former to be inclusive of £5000 already raised. The Company may likewise create and issue debenture stock. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

ELTON-STEPHENS AUTOMATIC LAMP LIGHTER.

In our notice of the exhibits at the Manchester Exhibition, brief allusion was made to the Elton-Stephens patent arrangement for the lighting and extinguishing of street-lamps, introduced by Messrs. R. Stephens and Sons. We were unable at the time to fully explain the operation of the arrangement. Among the points noted were that there are two types of the device, that no

Elton-Stephens Patent Street-Lamp Lighters.

liquid is used in their action, and that in Clevedon where the lighter has been employed since Aug. 11, 1906, lamps have been both lit and extinguished by the No. 1 type of lighter without the ordinary working pressures at the gas-works being altered in any way.

The action of No. 1 type lighter is as follows: Contained in the brass-casted case is a lever, which operates valves for the main burner and bye-pass. One side of the lever carries an adjustable weight, the other side has an oblique slot wherein slides a block, which is adjustable by a screw. This block is connected by a rod to a flexible diaphragm. When the gas pressure is raised at lighting time in the evening, the pressure on the diaphragm overbalances the weight, and the lamp is turned on. When the gas pressure is lowered at the night extinguishing time, the reverse action takes place; and the lamp is extinguished. These lighting and extinguishing pressures can be independent and be readily adjusted to anything required, making it possible to light by the evening increase of pressure, and extinguish at any other lower pressure. Should it be necessary to light with a decrease in pressure, instead of with an increase, the burners would be changed—*i.e.*, the main burner would be put on the valve originally intended for the bye-pass. The fittings of both valves are duplicate.

In type No. 2, there is a swinging rod fulcrumed on the end of the lever; and it is provided with a lateral projection, which co-acts with a cam-piece. On the first increase of pressure, the projection rides up the face of the cam-piece, and the lamp is alight. When the pressure is lowered, the projection drops into a recess, which prevents the light from being extinguished. To extinguish the light, a temporary increase of pressure is given, which lifts the projection out of the recess, and allows it to ride down the opposite side of the cam-piece. For some purposes, it is requisite that mere temporary increases of pressure in a cycle should be ineffective. For these cases, more recesses may be arranged.

It is of interest to note that as far back as eight to ten years ago, Sir E. H. Elton, Bart., and Mr. R. Stephens, in an experimental way, lit and extinguished some lamps in various parts of Clevedon by variation of pressure in the mains; so that their experience in this direction has been of considerable duration.

Mr. Charles Startup, a Director of the Gravesend and Milton Water-Works Company, left £15,067.

We have received from Messrs. Emmott and Co., Limited, of Manchester, "The 'Mechanical World' Pocket Diary and Year Book for 1908." This is the twenty-first annual issue of the work, and it contains some important changes. By the omission of the notes on electrical transmission of power, room has been found for new matter dealing with condensing plant and superheating. A section on friction clutches has been introduced, and several new tables have been added. Those appearing in previous editions have been modified; new illustrations have been introduced; and the whole work has undergone revision. It is a collection of useful engineering notes, rules, and data, and costs only 6d. net.

CHANGES AT THE CROYDON GAS COMPANY'S WORKS.

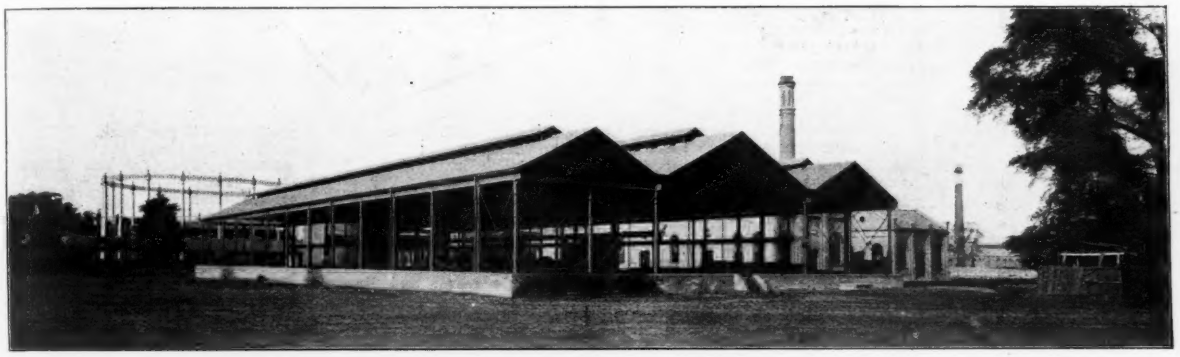
Novelty between the Retort-Houses and the Gasholders.

In the past few years, the Croydon Gas Company, advised by their Engineer and General Manager (Mr. James W. Helps), have, while developing their main body and organs generally, been engaged in the work of elongation, and elongation all in a southernly direction. On first blush, without knowing of the circumstances, the descriptive term may seem to be a little cryptic in its meaning. Take the district first, it has been elongated in the southernly direction. The Company cannot upon what may (without being too precise as to the points of the compass) be termed the north, east, and west of their district annex any new territory. They are bordered on those sides by such big concerns as the South Suburban Company, the Mitcham and Wimbledon Company, and the Bromley Company. But in the southern direction, there were the old Carshalton and Caterham Companies; and, to the advantage of the consumers and shareholders, the areas of these two concerns, as many readers are aware, have been united to the Croydon Company's supply district. If we look at the site of the Company's works, that, too, has been elongated in a southernly direction. Railway lines and a public road offered no other alternative; and so to the south of the site some time since the Company acquired and added another 10 acres or so, giving a total extent to the site of between 30 and 40 acres. On the works, again, No. 3 retort-house has been elongated in a southerly direction, and an imposing building it is now. But enough is said to show that the descriptive term employed in the opening lines has justification *de facto*. We have much to say about what has been erected on the new portion of the site; and also much to say about the objects sought to be attained by the general scheme of the plant, with its several novel features, which Mr. Helps kindly explained on the occasion of a recent visit.

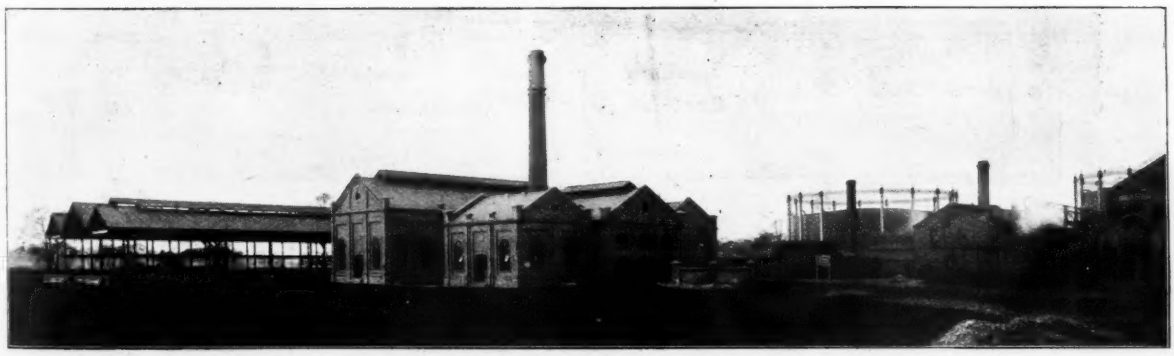
The Extended Retort-House and Other Plant.

The scheme we shall follow in this description will be to make brief reference first to the extension of No. 3 retort-house, succeeding with an account of the new plant dealing with the gas between that house and the holders, and then allude generally to the plans for remodelling and rearranging the old works. The old portion of the manufacturing plant—crowded and now ill-disposed for the immense amount of work that the production of gas for Croydon and the large district involves—has been closed down pending the carrying through of the scheme that has already been drawn up by the Engineer.

Let us therefore pass straight away to the No. 3 retort-house.



South-West View of No. 2 Section of the Works.

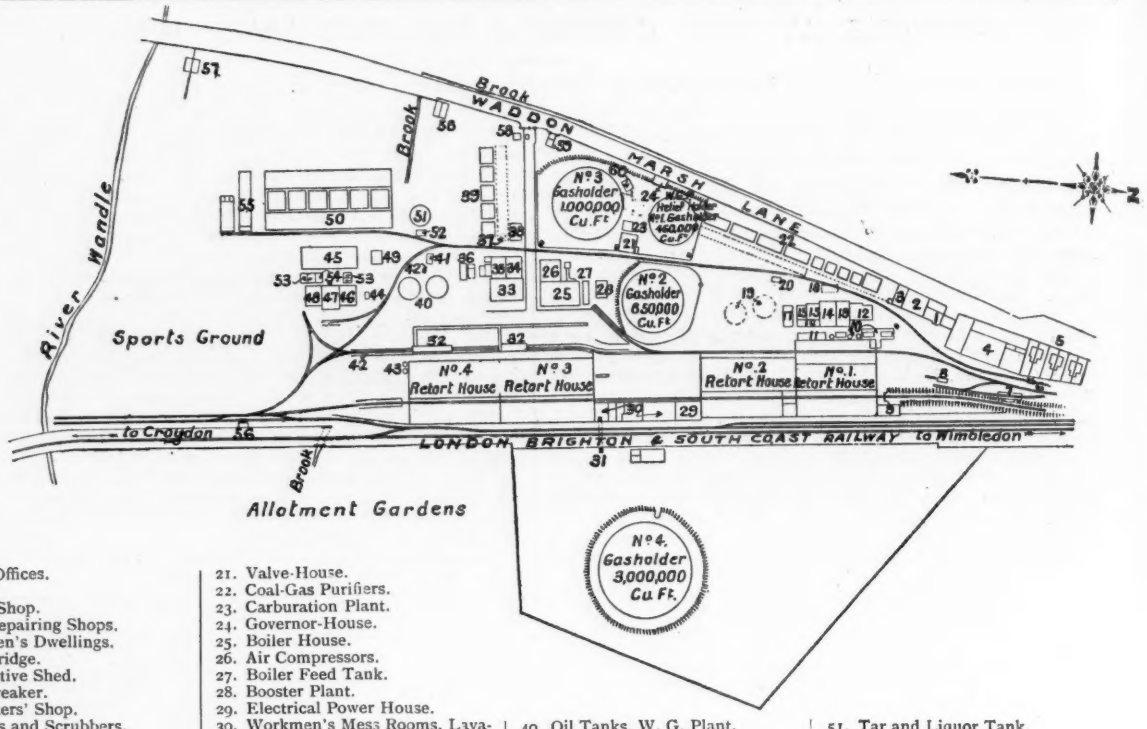


View of the Works from the South-East.

This house has been doubled in all respects, and it now presents to view a (as retort-houses go) magnificent building 400 feet long, by 72 feet wide, and flanked upon its rear side by a coal-store 50 feet wide. The house and its equipment need not be particularly described; an outline will suffice. It now contains 29 settings of eights, 22 inches by 16 inches by 20 feet long; and all the settings in the new part were built by West's Gas Improvement Company, Limited. There is nothing special to mention about the bench mountings; but it is noticed that the house is fully equipped with the Delamore method of removing the tar. The coal supply is dropped direct from a high-level railway into the coal-store; and from there four sets of breakers, and elevating and cross conveying machinery, feed the coal into the eight overhead hoppers—four on either side of the house—and each of a capacity of 40 tons. The retorts are drawn and charged by West's compressed-air machinery, which was described in the "Journal" when the first part of the house was built. When the machinery was originally adopted, what has now come to pass was contemplated; and the 29 settings keep the machines comfortably employed, to the best and most economical advantage. This house is capable of negotiating (with the carburetted water-gas plant) the present demand for gas in the depth of winter. The make is 9200 to 9500 cubic feet per mouthpiece per twenty-four hours; and, as there are 464 mouthpieces in the house, its productive capacity is not far short of 4,300,000 cubic feet. The biggest recorded output has been, in round numbers, 5 million cubic feet; so that, adding 30 per cent. of carburetted water gas, the capacity is in advance of requirements. But not so much in advance that Mr. Helps has delayed dismantling No. 2 retort-house, and putting it into condition (as will be described later) to be furnished with modern settings and other plant.

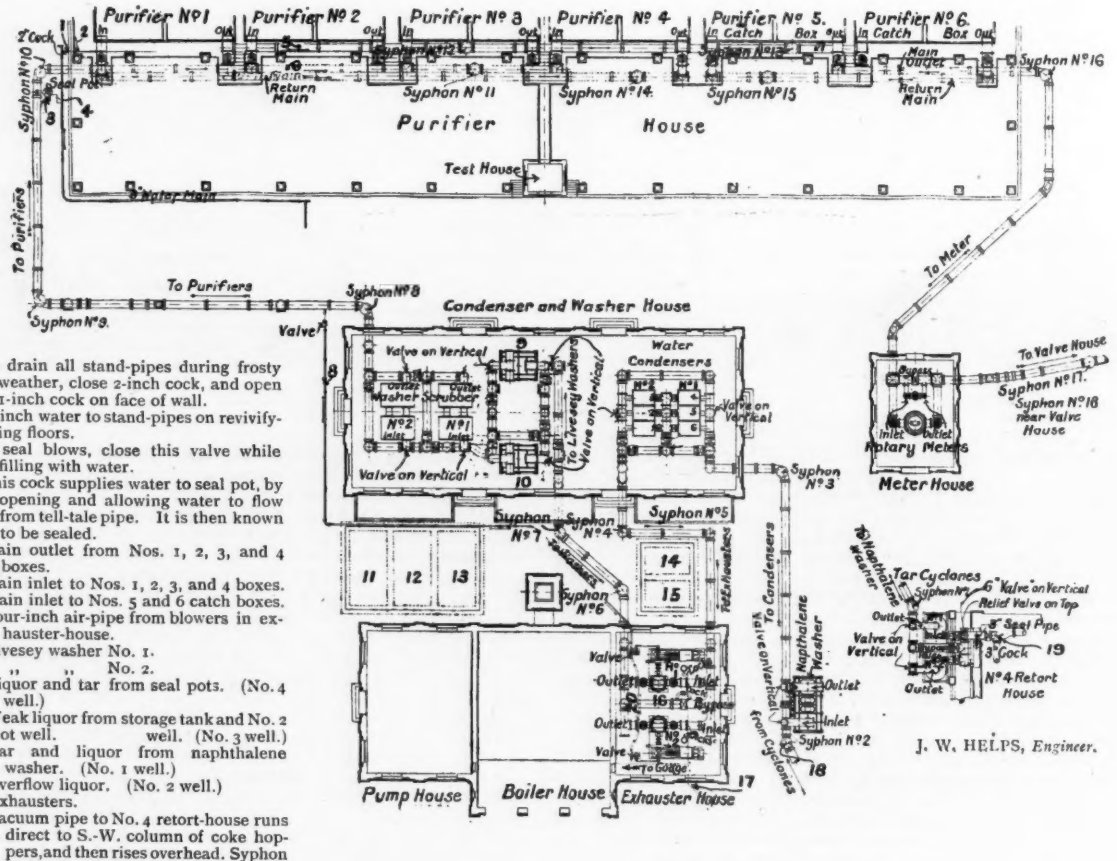
Still referring to No. 3 house, it is equipped with two complete sets of De Brouwer coke conveyors and elevating plant for storage purposes. Outside the house, it is observed that the railway waggon loading dock has been extended, and another set of overhead coke-hoppers has been erected—being practically a duplicate of the first set, and bringing up the total overhead storage capacity for coke to 400 tons. In connection with this coke plant, readers may be reminded that not only can coke be stored in the open, and in the loading hoppers, but there is a conveyor running overhead across the yard to the carburetted water-gas plant buildings, for transporting coke direct to hoppers for feeding the generators. The coke-conveying plant is all driven by gas-engines.

While inspecting this new coke plant, one considerable advantage is observed that will accrue from the addition to the site of the works at the southern end. When the works were limited to the old site, entrance and exit for coal and coke respectively were at the one end of the works. Now another set of sidings is being constructed at the southern end, and connected up to the main



1. Works Offices.
2. Stores.
3. Fitting Shop.
4. Stove Repairing Shops.
5. Workmen's Dwellings.
6. Weighbridge.
7. Locomotive Shed.
8. Coke Breaker.
9. Carpenters' Shop.
10. Washers and Scrubbers.
11. Condensers.
12. Smithy.
13. Boiler-House.
14. Exhauster House.
15. Meter-House.
16. Governor-House.
17. Pump-House.
18. Underground Tar and Liquor Tank.
19. Underground Tar and Liquor Tanks.
20. Overhead Tar Tank.
21. Valve-House.
22. Coal-Gas Purifiers.
23. Carburation Plant.
24. Governor-House.
25. Boiler House.
26. Air Compressors.
27. Boiler Feed Tank.
28. Booster Plant.
29. Electrical Power House.
30. Workmen's Mess Rooms, Lavatories, &c.
31. Subway.
32. Coke Hoppers.
33. Generator House, W. G. Plant.
34. Exhauster and Blower House, W. G. Plant.
35. Pump-House, W. G. Plant.
36. Underground Tar and Liquor Tanks, W. G. Plant.
37. Cyclone, W. G. Plant.
38. Meter-House, W. G. Plant.
39. Purifiers, W. G. Plant.
40. Oil Tanks, W. G. Plant.
41. Pump-House.
42. Artesian Wells.
43. Cyclones.
44. Naphthalene Washer.
45. Condenser, Livesey and Rotary Washer House.
46. Exhauster-House.
47. Boiler-House.
48. Steam Condenser and Pump-House.
49. Rotary Meter-House.
50. Coal-Gas Purifiers.
51. Tar and Liquor Tank.
52. Tar Sales Tank.
53. Underground Tar and Liquid Tanks.
54. Hot Well.
55. Sulphate Plant.
56. Weighbridge.
57. General Foreman and Chief Fitters' Houses.
58. Foremen's Cottages.
59. Motor Garage.
60. Cooling Tank.

Key Plan of Works, 1907—James W. Helps, M.Inst.C.E., Engineer and General Manager.



1. To drain all stand-pipes during frosty weather, close 2-inch cock, and open 1-inch cock on face of wall.
2. 1½-inch water to stand-pipes on revivifying floors.
3. If seal blows, close this valve while filling with water.
4. This cock supplies water to seal pot, by opening and allowing water to flow from tell-tale pipe. It is then known to be sealed.
5. Main outlet from Nos. 1, 2, 3, and 4 boxes.
6. Main inlet to Nos. 1, 2, 3, and 4 boxes.
7. Main inlet to Nos. 5 and 6 catch boxes.
8. Four-inch air-pipe from blowers in exhauster-house.
9. Livesey washer No. 1.
10. ,, ,, No. 2.
11. Liquor and tar from seal pots. (No. 4 well.)
12. Weak liquor from storage tank and No. 2
13. Hot well. well. (No. 3 well.)
14. Tar and liquor from naphthalene washer. (No. 1 well.)
15. Overflow liquor. (No. 2 well.)
16. Exhausters.
17. Vacuum pipe to No. 4 retort-house runs direct to S.-W. column of coke hoppers, and then rises overhead. Syphon 60 feet from this point.
18. Cleaning cover 65 feet in direct line to No. 1 syphon from this point.
19. Vacuum pipe to exhauster-house cock [on vertical.
20. Four-inch air delivery.

J. W. HELPS, *Engineer.*

Arrangement of Gas-Mains—No. 2 Section.

line, so that there will be double communication with the railway, and the operations of delivery and dispatch can follow an orderly and convenient cycle, without any of the interruptions and excess work that must necessarily result from the railway truck entrance being also the railway truck exit. What is more (Mr. Helps is keen on reversibility and ability to "free wheel" in his operations) entrance and exit of trucks can be reversed at will.

On the New Site.

At the end of No. 3 retort-house, or a very short distance beyond it, we are on the added 10-acre site. There was not a great deal of heavy levelling work to be done to it to make it suitable for the purposes in immediate view. A brook ran across it, and that was dealt with by constructing a concrete pipe-culvert for its conveyance, and covering over to the level of the adjoining land. The portion of the site that is not at present required for manufacturing purposes has been converted into a cricket ground, football ground, bowling green, and tennis courts for the employees; and with an engineer over the works with a bent for athletic exercises, we can imagine that the employees will be encouraged to make good use of the excellent and private facilities here afforded them for recreation in their leisure hours.

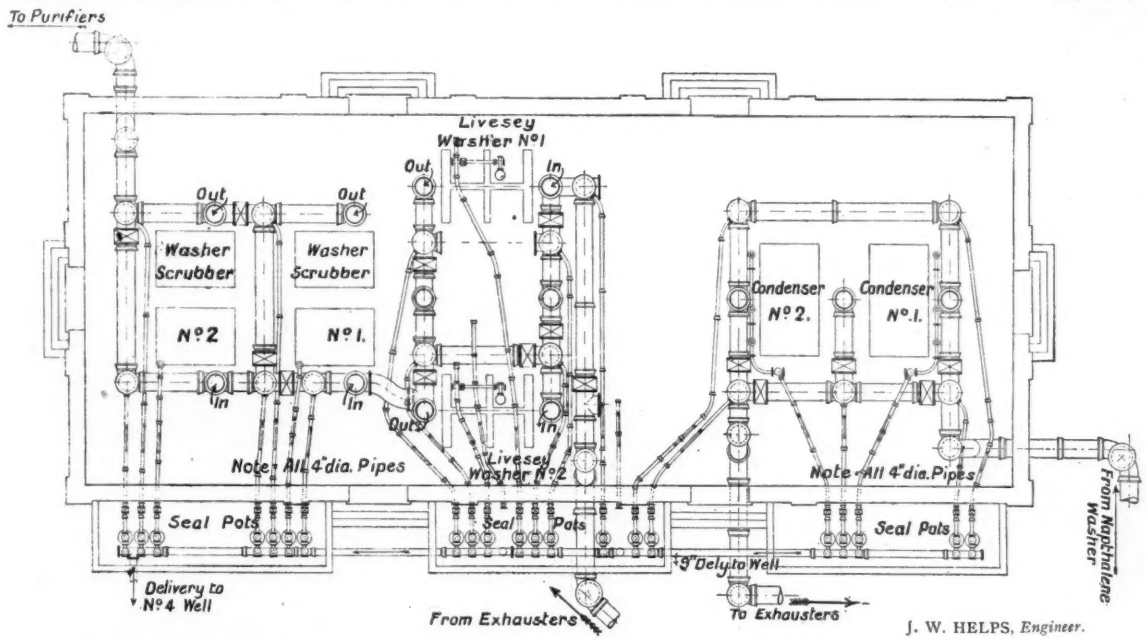
On the portion of the added site in juxtaposition to the old site are a number of attractive looking buildings, built of Kent stocks on the face, and picked out with Staffordshire blue bricks, with stone cappings and copings. These buildings contain the new plant comprising the new section of works. There is an exhauster-house, 40 ft. by 30 ft.; a pump-house, of the same dimensions; a boiler-house, 49 ft. 6 in. by 38 ft., with a chimney shaft adjoining 96 ft. 6 in. high; a scrubber and washer house, 110 ft. by 43 ft.; and a purifier-shed, 272 ft. by 127 ft. These buildings were erected by Messrs. G. E. Wallis and Sons, of Maidstone; the steel roof work being by Messrs. S. Cutler and Sons.

Cyclone Tar-Separators.

Having taken this general glance at the added site, and at the uses to which it is being at present put, we must retrace our steps to the end of No. 3 retort-house, so as to follow the course of the gas through the new section of plant, and simultaneously describe plant and process. The gas leaves the end of the retort-house by a 24-inch main, and close by, it undergoes its first purification treatment in two of Dr. Colman's "Cyclone" tar-separators, each of which is nominally a 2 million cubic feet unit. Testimony as to their efficiency is afforded by a remark of Mr. Helps that they are probably removing from 90 to 95 per cent. of the tar suspended in the gas. In the receivers at the bottom of the cyclones, the tar is seen coming off freely.

Dealing with the Naphthalene in the Gas.

Now for a momentary digression, in order to explain what is being attempted here in connection with the new plant. Briefly, it is that advantage is being taken of the information obtained during the inquiry into the naphthalene question by the Southern District Association of Gas Engineers and Managers. It will be remembered that, in the report to the Naphthalene Committee by Dr. Colman, he said that—to put the point generally—there were two ways of dealing with naphthalene, either by removing it altogether from the gas, or preventing its deposition in solid form by securing the inclusion in the gas of vapours of hydrocarbons boiling at something like the same temperature as naphthalene,



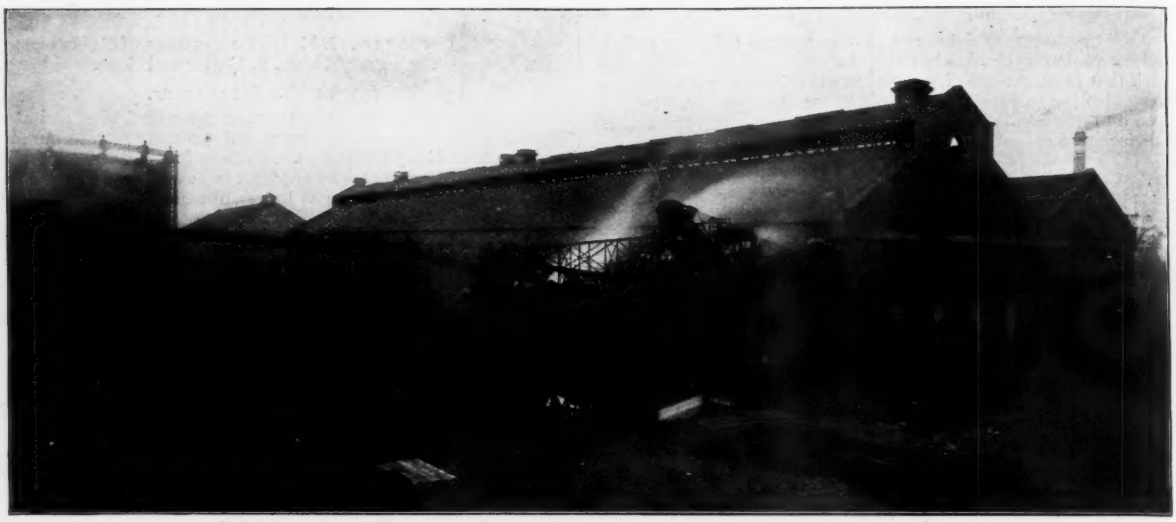
Arrangement of Tar Drains from Syphons, &c., to Seal-Pots for Mains in Condenser and Washer House.

but which are of themselves liquid at the ordinary temperature. If, in the latter case, naphthalene then separates from the gas, sufficient of these hydrocarbons separate with it to dissolve the naphthalene, and retain it in a liquid state, so that it never goes down in solid form. Dr. Colman, in the course of his investigation, also found that if (especially when using North-Country coal) the heavy tar was removed by a "Cyclone" tar-extractor from the hot gas, the amount of light tar left in the gas was insufficient to dissolve the whole of the naphthalene which separated out of the condensers, so that blockage of the condensers occurred as well as of the pipes carrying the tar from the condensers.

This brings us to the first part of what Mr. Helps is striving to do in this new section. He knows that, using the "Cyclone" tar-separators, he has got the condition last referred to—he has little of the light hydrocarbons left in the gas, and so it is necessary to put some into the gas, in order to obviate the deposition of naphthalene in the solid form. Therefore, as soon as possible after the "Cyclone" tar-separators, a Livesey washer is interposed in the course of the gas before it reaches the condensers. Into this Livesey washer is fed ordinary water-gas tar, which is rich in the desired hydrocarbons; and by means of a steam-coil, this tar is maintained at a temperature of 120° to 150°. Such temperature has not been finally determined as correct—it may be necessary to alter it; but it is the one at which Mr. Helps and Dr. Colman are at present jointly working. The gas, being drawn through this water-gas tar, has some of its naphthalene removed; but what is more important, it carries forward considerable quantities of the low-boiling hydrocarbons present in the water-gas tar. The plant is under vacuum; and it is placed before the condenser in order that the gas may be treated while it is hot—really, for the purpose, the hotter the better. Looking in the side-glasses of the washer, one sees the foaming of the liquid inside, and knows, from the investigations so far made, that within the actions described are proceeding. But to an extent, this introduction into the works' processes is in an experimental stage; and there may be deviation from the working rules that are at present being followed.

Points about the Housed Condensers.

The gas is piped from the Livesey washer to the house (the dimensions of which have already been given) in which the condensers and the scrubber-washers have been installed. In housing this plant, Mr. Helps has taken a leaf out of the books of Continental engineers; but it may be doubted whether such plant ever had better quarters allocated to it. The exterior of the house is attractive looking; and inside it is light and airy. The condensers (which are of the water-cooled multitubular type), were made by Messrs. Clapham Bros.; but they are to a great extent Mr. Helps's arrangement. To generally describe them, they may be said to consist of two large rectangular casings set on end; their measurement being each 20 ft. 6 in. high, 13 ft. wide, and 6 ft. 6 in. deep. Instead of being on the up-and-down principle, they are each divided into three separate compartments by means of feather plates, so that practically, it may be said, there are here six independent condensers. Each set is capable of dealing with 2 to 2½ million cubic feet of gas; or, to be well within the mark, the combined nominal capacity may be put at 4½ millions. In these condensers, the gas is divided into six different streams; and, by means of valves, the gas can be regulated to each division. Thermometers are provided, so that the work done by each section can be ascertained. The gas issues at the top of each set, and then the two streams mix. But there are no hard-and-fast lines about the working. If so desired, the gas can be taken up on the outside and sent down the condensers,



View of the Retort-House as Extended, with the Coke-Handling Plant—No. 2 Retort-House in the Distance.

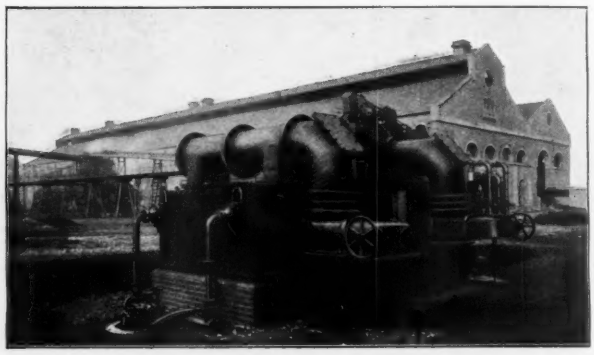
and out through the bottom valves, and the streams from the two sets be then mixed. In short, these condensers are independent units, are reversible, and, it is believed, will ensure very efficient cooling. What it is required to find out here is whether it is better for the gas to flow with the drop of the tar or in the opposite direction. Whichever way is proved the better can here, by the arrangements provided, be adopted. It is not costing the Company much to test this point for themselves, seeing that new condensers were an absolute necessity; and anyway it is always useful to be able to reverse the travel of the gas through condensers, in the event of a block.

The water for cooling purposes is pumped from the Company's 3 million gasholder tank into an overhead tank, and flows through the condensers at any desired rate, either up or down—that is to say, the water current is also reversible. From the condensers, the water flows back by gravity to the holder tank.

In the Exhauster-House.

We must, in order to follow the course of the gas, temporarily leave the house in which the condensers and washer-scrubbers are situated, and pass over to the building in which the exhausters are placed, which building is, of course, quite near by. The house looks well with its coloured walls, its dado of white glazed tiles, relieved with green, and with chocolate base. The floor, too, is of small red tiles. But the central features are the two sets of exhausters and engines. The exhausters are each of 200,000 cubic feet per hour capacity, and are driven by compound condensing engines of the Farey type. The Bryan Donkin Company, Limited, supplied the exhausters.

Looking round, a little blower is noticed—its object being the supply of air for revivification purposes to the new oxide of iron purifiers. It is driven by a belt off one of the exhauster engines, and is fitted with a series of stepped pulleys so that the speed can be regulated. A counter at the side registers the revolutions; and the work that is being done can thus be judged and controlled. It is also observed that the lubrication of the exhausters is being accomplished by a little mechanical arrangement driven off the shaft of the exhauster. A beautiful set of gauges is also of the equipment of the house. A further point noticed is that the floors are all solid; the steam and exhaust pipes being laid in trenches, covered by cast-iron plates, so that they are all accessible.

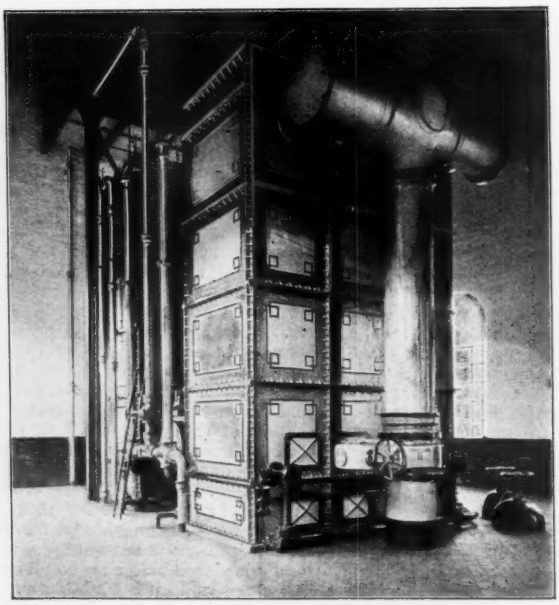


Hot Washer for Treating the Gas for Naphthalene, with the Extended Retort-House and Coke-Plant in the Rear.

The Washer-Scrubbers.

Returning to the condenser and washer-scrubber house. Occupying the opposite end of the house from the condensers are the

Dr. Colman's Patent Cyclones.

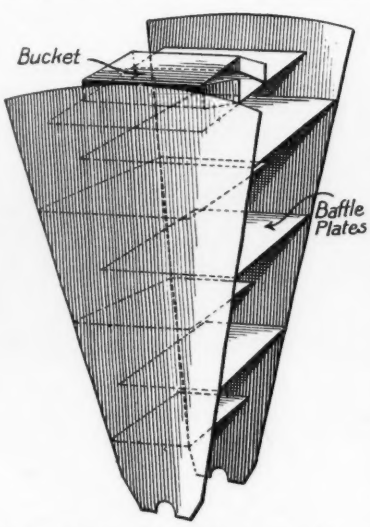


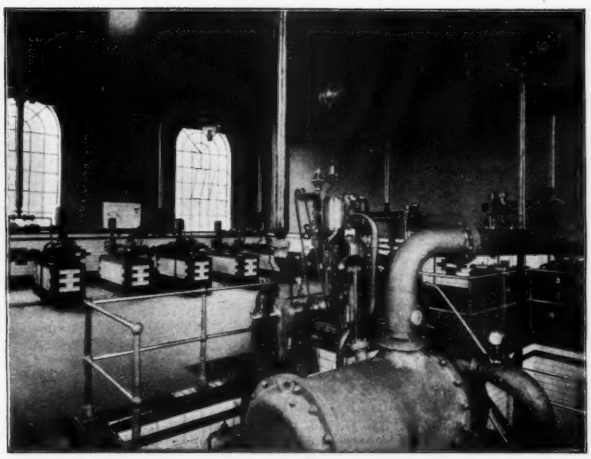
Reversible Gas-Condensers—Showing the Water Connections.

Exhauster-House.

Livesey Washers and the Washer-Scrubbers.

washer-scrubbers. First the gas passes through two 2 million cubic feet Livesey washers and two tar-extractors, which were supplied by Messrs. Willey and Co.; and there is space left for a naphthalene washer, which, it is naturally hoped, will not be required, in view of what has already been described regarding the addition to the gas of the light hydrocarbons of the water-gas tar. After passing through these washer-scrubbers, the gas flows into two 2 million cubic feet units of washers, of Messrs. Kirkham, Hulett, & Chandler's "Standard" type, and driven by small vertical engines and worm-gearing. These washers are filled with iron bundles, built up of corrugated sheets. In connection with washers so fitted, the difficulty has been frequently experienced of the congestion of the bundles by the formation of calcium carbonate—especially at the water-inlet end. In these bundles as ordinarily made, the plates are packed fairly together; and, of course, where there is a disposition for calcium carbonate to form and accumulate, this close packing—useful for the designed purpose of securing a large amount of surface in a comparatively small space—naturally tends to rather aggravate the difficulty. Therefore, in the first bay of these washers, the bundles have been differently constructed, so as to obviate the inconvenience as far as possible. It is rather troublesome to describe the variation in construction, so that it may be clear to the reader. But, generally put, the plates in these first-bay bundles have been fixed at right angles to the sides, alternately on either side of the frames, and about 4 or 5 inches apart. At the tops of the bundles inside, small buckets have been fixed; and these, as the wheels revolve, pick up water, which is dashed from plate to plate in zig-zag fashion—the gas meanwhile travelling in the contrary direction. By these means, any deposit of calcium carbonate on the plates is washed off and carried away with the water, and so no accumulation is allowed to block up the bundles.





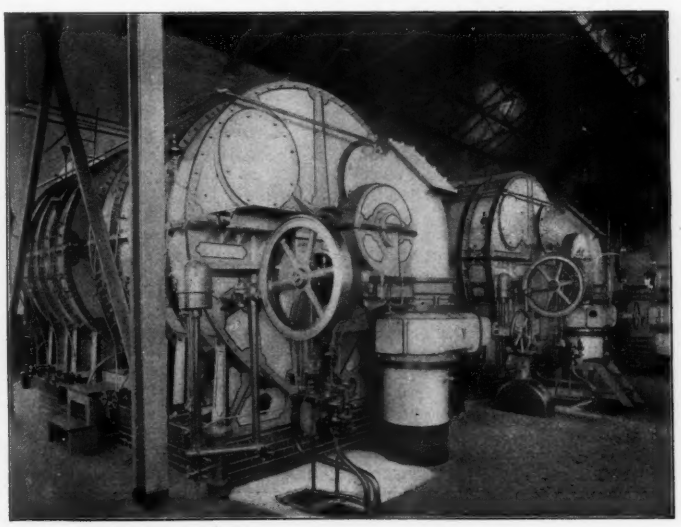
Tar, Liquor, Water-Circulating, and Feed-Pumps, Steam-Condensing Plant, &c.

In the foreground between the existing washers, space has been left for a cyanide washer should it be determined to adopt the recovery process.

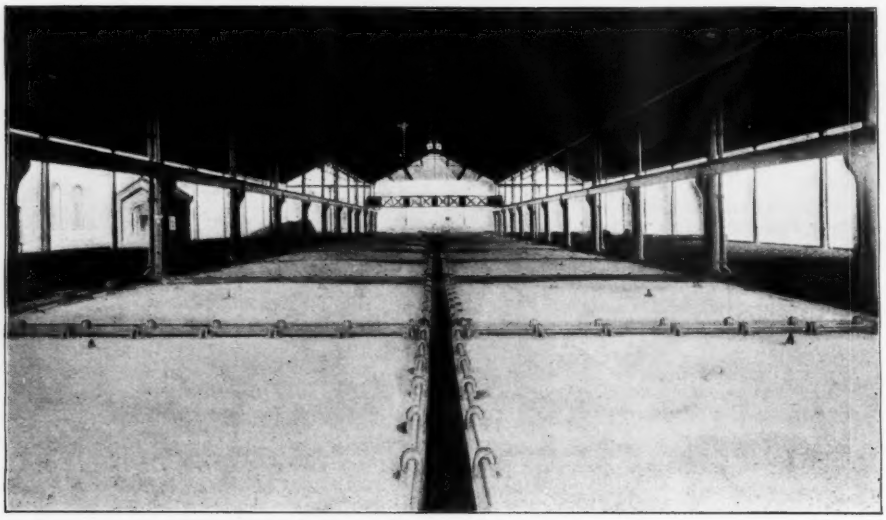
Accessible Connections.

In drawing up his scheme, Mr. Helps was somewhat exercised

Seal-Pots outside the Condenser and Washer House.



End View of the Washer-Scrubbers.

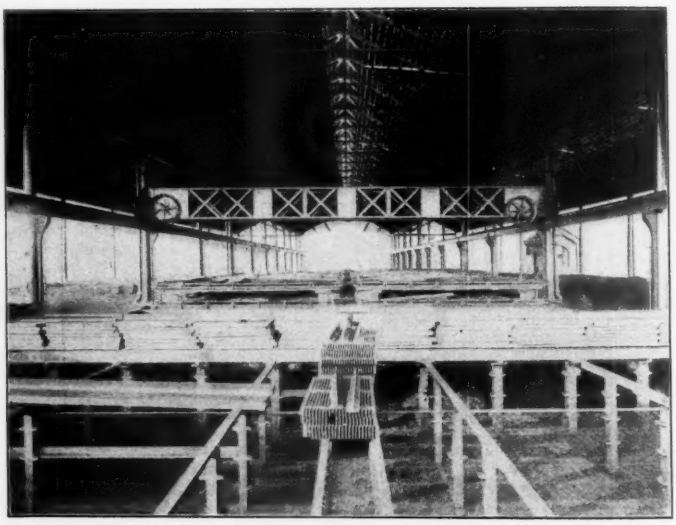


Interior of the Purifier House.

in his mind as to whether, in the condenser and washer-scrubber house, he should construct the building with a vault-floor, so that the pipes might be accessible underneath, or whether he should bury the pipes. The latter course has the objection that, whenever it is desired to get at the pipes, large holes have to be made. But Mr. Helps worked out a plan of dealing with his valves, connections, and so forth, which makes him and the attendants complete masters of the situation; and, compared with the construction of a vault and the provision of support for the pipes, &c., what he has done here has been accomplished at relatively small outlay. Regarding first the valves, it is noticed that the flange of the bonnet of each comes exactly on a level with the floor-line; and the bonnet itself is made to act as a standard for the valve. All that has to be done to get at the valve is to loosen the studs and take off the bonnet, and everything is exposed to eye and hand. To further explain what has been done, the drawing of the connections is the best possible description; but a few words may assist to direct interest. It will be noticed that, at the corners of all the connections, instead of the usual bends, syphons and clearing-out chambers on top have been provided. These chambers are covered with substantial lids, filled in with tiles to match the floor; and all that has to be done, if it is desired to clean out any of the pipes, is to lift off the necessary lids, remove the syphon or chamber covers, and, from point to point, the work can be performed with despatch and without any disturbance of ground. Thus all the advantages of a vault floor are obtained, without the danger of an accumulation of gas and at less expense; and at the same time all picking up of the ground is avoided. All the pipes taking the products of condensation and other liquids from the plant are assembled in a sunk open chamber outside the building, and each pipe is fitted with a valve and a seal pot. In the event of a stoppage, there will be no blowing inside, but it will take place here at the pot outside. These pots look rather small; but it is the easiest possible thing to shut the valves on the pipes, lift out the connections and clean them and the pots. The pots on the row of pipes connect up to a common receiving main running parallel with the building, which main delivers the tar, &c., into an underground well. But the whole arrangement is so clearly pictured that there is no need to say more.

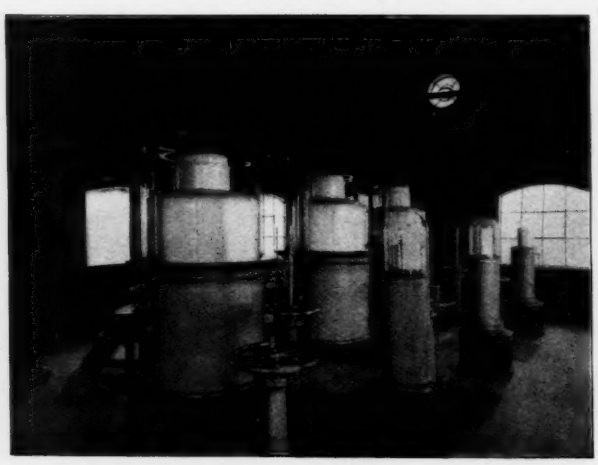
Pump and Steam-Condensing House.

Passing next to this house, the boiler and circulating pumps,

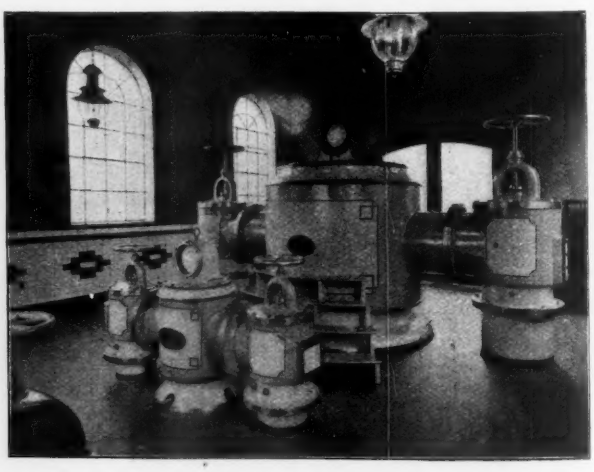


The Purifiers Open.

the tar and liquor pumps, and a steam-condensing plant are seen. Concerning the last-named plant, the water from one of the gasholder tanks is used. It is drawn from the tank, does its work, and then is pumped back again. Later on it is seen that, in being returned, the water is not pumped direct into the holder



Station Governors and Pressure Registers.



Rotary Station-Meters.

tank, but is passed first into an open cooling-tank alongside, and is then allowed to flow into the holder tank. A weir enables measurement at any time of the water passing in. The steam-condensing plant was supplied by the Bryan Donkin Company, and is used for condensing the steam from the engines. All the pumps, too, are connected up to it; so that, instead of having a pressure on the backs of the pistons and plungers, there is a vacuum of about 27 inches.

The Boiler-House.

For the purposes of the new section only, located between the exhauster and pump houses, is the boiler-house; but it is a small house compared with the one on the old part of the works, with its fine range of boilers. However, in this new house, there are two Lancashire boilers 30 ft. by 8 ft., and space is left for the accommodation of a third when occasion requires. The boilers are by Danks and Co. Among the observed points, is a self-acting valve, fixed at one side of the house in connection with the condensing arrangements. If anything goes wrong with the condenser, the valve will open of its own accord, and give vent to the air—having no other effect than that of converting from the condensing to the ordinary system. Breeze is used under the boilers, but no forced draught. It is also remarked that the "Northern" (Varty's patent) fire-bar is used. Each bar has its main centre piece, from which curved ribs project. Some advantage is claimed from the passage of the air through these curved ribs; but whether or not there is really any advantage, the fact remains that at the Croydon works very nearly as good results are obtained with these boilers as with those fitted with forced draught.

The Purifier-Shed.

Now we come to the purifier shed, which is open on all sides, and is simply covered with an iron and slate roof, in three spans, supported on iron columns. Under the central span there are the purifiers, luteless, and six in number. They are 5 ft. 6 in. deep by 40 ft. square; and each is provided with four covers, each 19 ft. 2 in. square. It will be remembered that, at a meeting of the Southern District Association, when this question of luteless purifiers was under discussion, Mr. Helps pointed to the inconvenience in dealing with the material of having wide fixed staging between the lids and round the sides; and in these purifiers no one can accuse him of not practising what he has preached, for the staging between the lids only measures in width some 13 inches—there being no staging whatever round the sides. Across the purifiers are carried T-bars to act partly as ties and also as supports for the planks when wheeling the oxide in and out. The contract for the purifiers was let to Messrs. Clayton, Son, and Co.; but Clapham's patent "Eclipse" rubber joint is used, and the lids are fitted with Milbourne fasteners and valves, by Messrs. C. & W. Walker, who also supplied the cover-lifting apparatus. Of the six purifiers, four are worked in rotation; and the other two are being used as catch boxes. The valves to the purifiers are situated in chambers in the revivifying-floor, which chambers are merely covered by wooden lids. A few words about the revivifying-floors. From what has already been said, it will have been gathered that the purifiers are at the ground level; but the interesting feature is that the revivifying-floors which are under the two side spans of the shed have been built up to the level of the tops of the purifiers—the objects being to avoid having to excavate and get into water, and to facilitate the unloading and loading of trucks alongside, and to conveniently deal generally at one level with the purifying material. At the side of one of the revivifying-floors is a small laboratory. The whole of the pipes from the purifiers have been brought to it; and so pressures can be taken, and all the ordinary tests be made for carbonic acid and sulphuretted hydrogen, on the very spot. The gauges used are Helps and Cloudesley's patent, and were supplied by Messrs. Parkinson and W. & B. Cowan. They are very simple arrangements, and can be taken out and cleaned quite easily.

Sulphate of Ammonia Plant.

A site has been allocated for a new sulphate plant. It is a short distance from the southern end of the new purifier-house.

Framed Plans.

One feature noticed in passing through the various buildings was that in each there are framed plans, similar to those that we are reproducing. They are boldly drawn and coloured, and every part of the plant is described in good-sized lettering. The valves, syphons, &c., are numbered or lettered to correspond with the plans; so that the attendants have before them at a glance every pipe, connection, and valve. We can imagine the usefulness in an emergency of having at hand these graphic representations.

An Annular Tar and Liquor Tank.

Passing from the purifier-house, a new above-ground tar and liquor tank is noticed; and it is explained that it is annular inside—the central portion being used for tar, the liquor welling over into the surrounding annular space. The central part will hold about 80,000 gallons of tar, and the annular space 240,000 gallons of liquor; so that the total capacity is 320,000 gallons. Perhaps some reason should be assigned for the construction of the tank in this way. It is simply this, that at Croydon there has been some difficulty in separating the water from the tar; and Mr. Helps's idea was that, by having a central space for the tar, and running round it at the bottom a 2½-inch steam-coil, the stuff would keep warm, and separation would be more easily effected.

"Rotary" Station Meter.

We come to the new station meter-house, which is only a small building, but really quite large enough for the Thorp and Marsh "Rotary" meter of 180,000 cubic feet per hour capacity which has been installed as the station meter for the new section of plant. By it is situated a smaller meter, which is brought into use on occasion. The "Rotary" meters are, Mr. Helps has found, correct until the gas passing through them gets down to below 7 or 8 per cent. of the nominal capacity of the meter. But the only time at Croydon when there is a fall to below 7 or 8 per cent. of the capacity of the large "Rotary" meter is at the time of shutting down and starting up on Sundays. Thus the presence is accounted for of the little auxiliary meter of 20,000 cubic feet an hour, which, on Sunday morning when "closing time" is nearing, is brought into use, and the large one shut off. In one corner of the building is noticed a spare interior for the large meter; so that, if there is a suspicion that the meter requires cleaning, the inside is merely lifted out, and the spare one put in its place—the change being completed in an hour or so.

A Boosting Plant.

In another house not far away are seen a couple of splendid boosting plants—each comprising a 70-horse power De Laval turbine and a Sturtevant blower, each capable of dealing with 750,000 cubic feet of gas an hour. The gas is conveyed to the plant by a 30-inch main; but the plant is only brought into action when a heavier pressure than the ordinary is required—a bye-pass arrangement being employed at other times.

A Water-Softening Plant.

Another fresh introduction is a water-softening plant, by the Pulsometer Engineering Company, Limited, capable of dealing with 4000 gallons of water an hour. The water is supplied from two artesian wells (about 400 feet deep) on the works, from which the water is raised by the air-lift system. The wells will supply about 4000 gallons of water an hour, which is just about enough to meet the requirements of the works.

A New Governor-House.

What is known as No. 2 governor-house is also a fresh accession to the plant. It contains three 24-inch water-loaded governors made by Messrs. Parkinson and W. & B. Cowan. One deals with the supply to Croydon Old Town; and the second and third, with the supply to the Carshalton and Thornton Heath districts respectively. While inspecting these governors, it was gathered that the Caterham district is now supplied from these works by a 24-inch high-pressure main, which is untapped until it gets to Purley, when a 12-inch main is taken off it, and is governed there. The main delivers into the holders at Caterham, some 6 miles distant from the Waddon works.

Remodelling the Old Section.

Leaving all the interesting work associated with the new section and with other improvement, we pass to the old section, where, excepting for the change now proceeding in No. 2 retort-house, all is silent. The old section has had its day, and has finished its duty until it is modernized and rearranged. The whole of the old-fashioned settings of No. 2 house have been cleared away. Formerly this house had a coal-store on either side, each 40 feet wide; and the retort-house itself was 60 feet wide. But one of the coal-stores was fed by a high-level siding and the other by a low-level one. Mr. Helps has discarded the low-level store and retained the high-level one, and has made the house 72 feet wide, and 20 feet higher than the old one—it being now 48 feet high to the eaves. It is in its bare condition a capacious looking house. The alteration to the building has been made by Messrs. Wallis and Sons, of Maidstone; the iron roof work is in the hands of Messrs. C. & W. Walker. The house will later on contain fifteen settings of tens, worked by West's compressed-air stoking machinery, which is an indication that Mr. Helps has not been converted to the belief that there is yet any superior advantage in any other form of retort-house machinery. In this house, however, it is intended that the spent charges shall be pushed out instead of being drawn. The West Gas Improvement Company will construct the settings. The house will be equipped completely with coal-handling plant by the same firm; and, as pushing and not drawing is going to be resorted to, one line of coke-conveyor will suffice. The coal and coke plant is going to be driven by electricity; and the Company will have their own electricity generating plant driven by gas-engines. They will be able to afford an object-lesson to manufacturers at Croydon who have a preference for electric driving.

In the prospective scheme stands the transformation of No. 1 house; and if intentions are consummated, Nos. 1 and 2 houses will eventually present themselves as duplicates of No. 3 house—that is to say one building 400 feet long. But who knows what may happen before the conversion of No. 1 house is a necessity? Even Mr. Helps may by that time be longing for an opportunity to incorporate vertical retorts or large carbonizing chambers in his manufacturing system.

In addition, the whole of the plant in the shape of the condensers, scrubbers, washers, and so on are coming down, and will be replaced in a more convenient position, so as to constitute another complete and economically operating section.

[The excellent photographs accompanying this article were taken by Mr. F. J. Harrisson, Mr. Helps's Chief Draughtsman.]

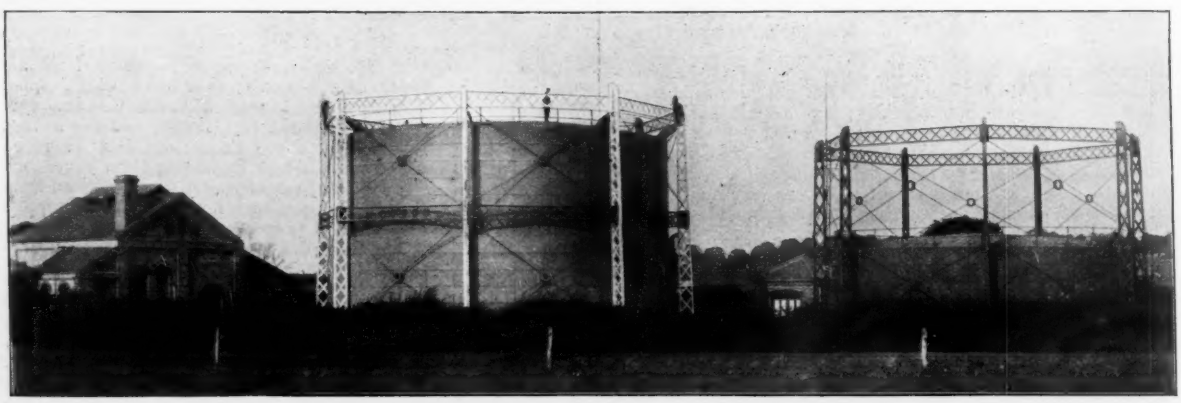
THE PUBLIC SERVICES OF THE FIRST GARDEN CITY.

A Hundred and Fifty Per Cent. Increase in the Consumption of Gas—The Extension of the Works.

Two years ago the writer was in the First Garden City, otherwise known as Letchworth. The occasion was the opening of the new gas-works—a model gas-works in completeness and in modern equipment and method—which had been designed by Mr. Charles Hunt, the Consulting Gas Engineer to the First Garden City Company. The writer was again in Garden City on the first working day of last week. The day was wet and cheerless, and yet somehow or other there was a feeling of pleasure in being in First Garden City. It is all so novel, so picturesque, fresh, and free, so unlike is it to the crowded city, the prosaic town, and the inconvenient—sometimes tumbledown-looking and not infrequently insanitary cottages of the ordinary village. On all hands, there are signs of development. In the two years that have sped their course since the first visit, many more houses and some extensive factories have sprung up on the 3818 acres forming the area of the estate. There are now, in fact, 932 houses built or in course of erection; and there are twelve factories there and four workshops. The population is now upwards of 5000; and will be a great deal more when the tenants for whom the new houses have been constructed are in occupation. The shops in the district, too, now number 44; and among them is noticed a well-stocked show-room for cooking and heating appliances tenanted by Messrs. Parkinson and W. & B. Cowan. Unfettered but little by local authorities and by Acts of Parliament, with rates at only 2s. 6d. in the pound, fully furnished with all modern services, and only about fifty minutes' ride from London, there is no need to marvel that First Garden City is expanding in estimation for both residential and manufacturing purposes, along the lines laid down with practical wisdom by the promoters of the scheme, and which lines preserve unique feature and all the attractions of a rural and simple life.

Gas Expansion and Works Extension.

But the object of the writer's visit was to inquire how fared the interesting gas-works scheme which was inaugurated in the autumn of 1905; and the information gathered last week from Mr. A. W. E. Bullmore, the Resident Engineer of the First Garden City, was somewhat surprising. Be it remembered this is a town started, with very definite aims, on virgin soil. The gas-works were the same; the likely business was an unknown quantity—everything, in fact, had to be measured on a speculative basis. Mr. Charles Hunt designed works, placed them in an ideal position by the railway, and hidden away among trees, for a first production of 6 million cubic feet per annum; but he left everything prepared for a ready and economical extension to an output of 20 millions. Well it was that he did so. The first year's business of 5 million cubic feet warned that the 6 million provision was altogether inadequate; and without loss of time, Mr. Hunt had to avail himself of the arrangements he had made for the easy extension of the plant. In the second year's working, ending September last, the consumption had risen to 12½ millions, or an increase of 150 per cent. on the first year's business. An increase for a brand-new town, developed on what were but fields some three or four years ago, is remarkable; it is an altogether different thing from setting up a gas-works for the first time in a well-established town. The increase reckoned as a percentage on the previous year's business is also notable; and that



A General View of the Gas-Works at "Garden City."

too must, in a way, stand unique in the annals of gas supply. It is something to be proud of under the circumstances of the undertaking and the development of a new town.

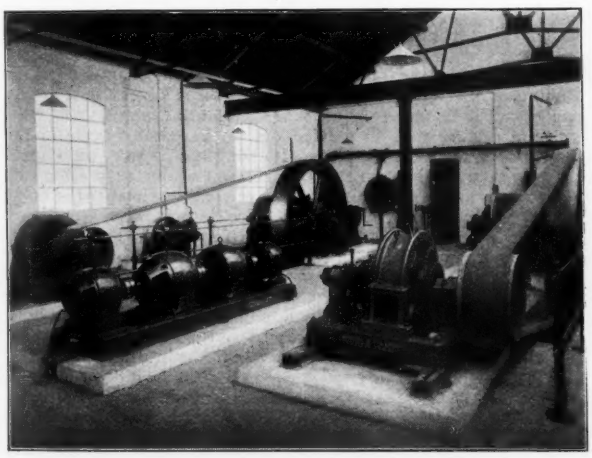
These gas-works at Garden City are unique, in that they owe no allegiance whatever to any one save to their own proprietors, who are also proprietors of the estate, and are under no other control. They are not "cribb'd, cabin'd, or confin'd" by Act of Parliament. They can be run by their proprietors in the best way possible to serve the interests of their "city," and to give the householders and manufacturers a cheap supply of gas of such quality as is suitable for present-day purpose, and such as will retain patronage. The Garden City Company do their best to foster consumption. Acting on Mr. Hunt's advice, they connect the supply up to the houses, including meters, free; and supply cookers and gas-fires at a merely nominal rental which is sufficient to cover depreciation. They started by supplying gas for all domestic purposes at 3s. 3d. per 1000 cubic feet (the charge to-day is 3s.), and for power purposes from 2s. to 3s. according to use. Such prices are noteworthy, and are to be found in few towns with small populations, but old-established works. The result of all this encouragement is that to-day every occupied house has its gas supply; and so the number of consumers at the close of September was 310 ordinary and 346 prepayment—together 656, or an increase in the twelve months of 253. There will be, it is anticipated, a considerable addition to this number in the course of the present twelve months; and it is estimated that the consumption will be at least 18 millions. In addition, there are eight gas-engines in factories under supply. The purposes for which the gas-power is at present used will be judged by mentioning that the engines are situated in the book-binding factory of Messrs. J. M. Dent and Co., the works of the Heatly-Gresham Engineering Company, the Garden City Press, Limited, Messrs. Vickers and Field, Limited, asphalte manufacturers, Mr. H. Hall, for driving chaff-cutting machinery, the Garden City Swiss Embroidery Factory, and Messrs. Wheeler, O'Dell, and Co., printers. Gas is also connected up to the electric power station (about which there will be further mention later) to drive the generating plant in cases of emergency. It is worth passing remark that the use of gas for power purposes and for cooking, causes the output to be larger in the day-time than at night-time for the greater part of the year; and the summer consumption is only about one-third below that of the winter. If business continues to develop on these lines of day and night and seasonal proportions, it will be approaching as near an ideal condition for economical production as can be obtained. While speaking of the consumers and consumption, it may be stated that the public lamps now number 80.

These particulars of excellent progress were gathered during the visit; and they are the results of enlightened management. Increasing consumption of gas through the development of the "city" and the wise inducements offered to the residents has, as already mentioned, necessitated the extension of the works. They were, as previously stated, designed for a commencing output of 6 million cubic feet; and with, in some directions, an ultimate output of 20 millions, to about which capacity it has already been requisite to bring them, although the new plant is in most respects equal to an output of 30 millions. The retort-house, readers may be reminded, is 42 ft. long by 34 ft. wide. But vacant land has been left for an extension of the building; and it is pretty safe to say that the time is not far distant, having regard to what bids to be a very profitable investment in gas supply in Garden City, when some of this vacant land will have to be occupied. At the outset, there were only two regenerative settings in the building—one containing five retorts, the other three. And now it is seen that Messrs. F. C. Sugden and Co. have completed a further contract for two beds of six retorts, 22 in. by 15 in. by 9 ft. 6 in. long—making the total number of retorts twenty. The next move will be to convert the original beds into sixes. The charges are 3 cwt., and six-hour working is the rule. A retort governor is in use. But the most imposing extension that has had to be made has been the erection, by Messrs. Westwood and Wrights, of a two-lift holder of 87,000 cubic feet capacity. The bottom lift is 60 ft. diameter and 18 ft. deep; and the inner lift 58 ft. diameter, and 18 ft. deep. On the site the foundation is good chalk;

and the tank (which is 62 ft. diameter) has been built of concrete, cement rendered—the contractors being Messrs. Davies, Ball, and Co. The holder with which business started two years ago was a single-lift one, 50 feet in diameter, and of 26,000 cubic feet capacity. So that the total storage is now 113,000 cubic feet; and next year a second lift will be added to No. 1 holder. A new exhauster (by Messrs. R. & J. Dempster, Limited), of 5000 cubic feet an hour capacity, driven by a small Crossley gas-engine, has also been put in; the condensers have been extended; and the purifiers have been duplicated by Messrs. Westwood and Wrights—the set now consisting of four luteless boxes, 8 ft. square and 5 ft. deep. Alongside, the purifier-house an oxide revivification shed is about to be constructed—the intention being to depart from lime purification. Lime is fairly cheap in the neighbourhood; and it was adopted at the outset—the use of oxide being left for the time an open question. The spent lime only realizes a nominal sum for agricultural purposes; and it is considered that, altogether, the balance of advantage will be on the side of oxide. Hence its adoption very shortly.

On the way to the works, it was noticed that a new 12-inch main is being laid into the factory area—another evidence of the striking growth of demand in this new town. It was learned from Mr. Bullmore that the unaccounted-for gas last year was only 3 per cent. This is a matter upon which he must be complimented, more particularly seeing that last year several miles of new mains were laid, and a large number of new services were connected. Such work cannot go on without some loss of gas. There are now 12 miles of mains laid. This may appear large in comparison with the output; but it must be remembered that the building development of the area must necessarily during the first few years take a somewhat scattered course.

There is one other interesting point about which inquiry was made, and that is the question of illuminating power. In view of the fact that it was intended that flat-flame burners should be



Interior of the Power House.

almost unknown in Garden City, and so practically all the gas would be used in bunsen burners for lighting, cooking, and heating, and exploded in the cylinders of gas-engines and utilized in other industrial service, there were visions of supplying a 12-candle power gas. The rapid expansion of the consumption of gas, however, interrupted this plan. With a holder of only 26,000 cubic feet storage capacity and only two settings of retorts, it was found imperative to work at high heats and with short-hour charges; and therefore 14-candle gas has been about the quality supplied. Now, however, the extensions of the plant will enable greater freedom in the makes per ton, as also in the reduction of illuminating power.

The Electricity Station.

The supply of gas, it is seen, has made an excellent start; and everything points to the concern proving a flourishing one for the Garden City Company. They have not sought to make profit from it right away from the start; rather preferring, as has been shown, to establish a good business by a line of policy that courts success. The same policy is being applied to the electricity undertaking. On the north side of Works Road, the station has been erected; and to it a visit was paid. It is in quite a central position in the factory area. The building has been so designed that it is capable of easy extension as necessity demands. The plant consists of two 100 brake horse power Campbell gas-engines, with two sets of suction-gas plant. As remarked earlier in the article, arrangements have also been made for the supply (as a reserve) of the engines with town gas. There are two dynamos, of Messrs. Johnson and Phillips's make, driven by the engines, each capable of a continuous output of 65 kilowatts at 500 to 550 volts continuous current. The accumulator battery consists of 260 cells, and can give 300 ampère hours when discharged in ten hours. The supply is on the three-wire system—500 volts on the outers and 250 volts on the inner and the outer. The station has only lately been started; so that no working data are at present available. It may, however, be stated that it is—for at any rate the time being—only intended to supply current in the factory area for industrial purposes—the prices being, in the factories, 1d. per unit for power and 2d. for lighting. Current is being supplied to Messrs. W. H. Smith and Son's extensive book-binding factory, which has been transferred completely from London; and the Arden Press and Garden Press Companies are also consumers. Private lighting is out of the question at present, as the amount of likely custom would not justify the expenditure on cables. The electricity plant was designed by Messrs. O'Gorman and Cozens-Hardy. Mr. Bullmore acted as Resident Engineer. In this way, he has had a unique experience in having under his superintendence the laying down and subsequent working of all the public services associated with Garden City.

Extension of the Water-Works.

With the increase in population to already 5000, the time has arrived when new plant for water-supply purposes must be laid down. The first pumping-station incorporated a borehole, about 14½ inches in diameter, 220 feet deep, and protected to the depth of 166 feet by steel tubing. The water was first touched at 90 feet; and the chalk proved water-bearing all the way down from there to the bottom. The water is pumped to a reservoir on the Weston Hills at an altitude of about 480 feet, which gives 160 feet head to any building part of the estate. The lift and force pumps are driven by a 32-horse power Campbell gas-engine; the gas being supplied by a suction-gas producer. The capacity of the reservoir is 250,000 gallons; and the pump will lift 120,000 gallons per day. The plant only works for about 45 hours a week. In a test there was a total depression of the rest-level of the water in the well to 3½ feet; and on the cessation of the test-pump the water recovered its rest-level in 15 seconds. The supply, with a population of 4500, is about 500,000 gallons a week, which works out to 16 gallons per head per day. This is very good considering the usage and waste through building operations. It has now been decided to sink another borehole in close proximity to the first one, and to put down a second pumping plant. The contract for sinking the borehole has been let to Messrs. Legrand and Sutcliffe, who also carried out the work connected with the first one. The Garden City Company have entered into an agreement for the supply of water to the Baldock District Council for furnishing about 2000 inhabitants with water up to a maximum of 30,000 gallons daily. At the present time, there are 18 miles of water-mains laid in Garden City.

Suction-Gas Plant Working.

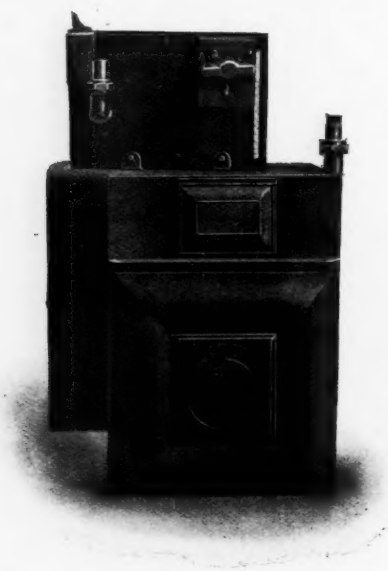
In view of the fact that Mr. Bullmore has had experience of the suction gas plant both at the water-works and at the electricity station, inquiry was made of him as to his experience. His testimony is that, with a steady load these plants give most satisfactory results; but when the load is uneven, there is a different tale to tell. The figures for the water pumping, Mr. Bullmore regards as almost ridiculous in their moderateness. Take his pumping returns for the twelve months to Dec. 1, 1906. The pumps worked 1357 hours, and threw 11,220 gallons an hour. The total number of gallons pumped was therefore about 15,000,000. The total quantity of anthracite used was 25 tons 14 cwt., at, including carting, 28s. per ton. The water pumped per hundredweight of anthracite used was thus 29,182 gallons; and per 1000 gallons 3·8 lbs. The cost of pumping 1000 gallons was therefore $\frac{9}{16}$d.; and wages, maintenance, repairs, insurance, stores, &c., brought the total cost of pumping per 1000 gallons up to 2⅜d.

This article comprises the interesting information gathered as to the public services of Garden City in which "Journal" readers are concerned; and it is to us a pleasure to devote time and space to portraying the development of this unique scheme of modern conception. Above all things, we naturally congratulate the Company on the singular and early good fortune that has attended the building up of their gas-supply business.

Scottish Junior Gas Association (Western District).—The members of the Western District Section of the Scottish Junior Gas Association paid a visit last Saturday afternoon to the Pinkston station for the generation of electricity for use in the tram car service in Glasgow. There was a good attendance of members, numbering about fifty, including the President (Mr. W. Wilson, of Falkirk), Mr. Alex. Wilson, Gas Engineer to the Corporation, and a number of other honorary members. In accordance with custom—there being so many visits to the station—there was no reception of the members of the Association; but the officials in charge gave full information, when asked, about the working of the plant. What most impressed the visitors were the five mammoth engines, each of 5000 H.P., one of which is of Scotch, two of English, and two of American manufacture. Each of these has a fly-wheel weighing 120 tons. The engines are direct-coupled to a three-phase generator weighing fully 90 tons. The members walked about the station as they pleased, and departed after the inspection, as they arrived, without any ceremony whatever.

A MULTI-COIN PREPAYMENT ATTACHMENT.

THERE are some things that must be seen to be fully believed. A prepayment meter that will take various coins—two halfpennies, a penny, a threepenny piece, a sixpence, or a shilling, or any combination of these coins—and deliver with all honesty the value in quantity of gas is one of the things. We have grown accustomed to prepayment meters that will only take a coin of one denomination, and only deliver the amount of gas paid for by coins of that particular denomination; and it has not appeared possible that there could be, in a mechanical appliance free from complication and costliness, any departure from the principle of the mono-coin meter. In November last, however, the intelligence was conveyed to our readers, through an article in the "JOURNAL" for the 13th of that month, that Mr. Charles Hibberd, of Auckland, New Zealand, had invented a multi-coin attachment for prepayment meters which would do what has been assumed by makers and users alike to be impossible. When that article appeared, the new attachment had only been developed for wet meters—this type of meter being the one favoured with preference in New Zealand. Mr. Hibberd arrived in London with his ingenious attachment at the end of last year, but discovered



A Dry Meter with the Multi-Coin Attachment.

that preference here was on the side of the dry meter, and that the wet meter takes a secondary place, as shown by the degree of adoption in professional estimation. Nothing daunted, he set to work to adapt the new mechanism to the dry meter; but it caused a few months' delay in bringing it prominently forward. It was only two or three weeks ago that he completed the adaptation to his satisfaction; and, as is often the case, the simplest plan of doing it was about the last one that occurred to him. Since then he has had many men skilled in meter-making and connected with the sale of gas to see the meter at his offices, at No. 47, Victoria Street, S.W.; and, no doubt subject to further personal trial, they have all spoken in terms of high approbation of the attachment, of their pleasure that this advance has been made, and of the obvious usefulness to seller and consumer of gas alike of a multi-coin meter over a mono-coin one—more especially seeing that the cost of the one need not exceed the cost of the other. Of course, it follows that anything that is a convenience to the gas consumer must be of value to the seller of gas in popularizing his supply; and, moreover, the growing burden upon the seller of gas of pence payment must be largely relieved by the future adoption of an attachment that enables the consumer also to purchase by silver coins, and what is more from a pennyworth up to (by a combination of coins) five shillingsworth of gas at a time.

The invention is covered by patents in fourteen countries; and the most rigorous search, Mr. Hibberd tells us, has failed to disclose any anticipation. Therefore, he believes with good cause that he has in the attachment an excellent thing, and one which will commend itself in this country as it has done in New Zealand. Before dealing further with the operation of the meter and its advantages, a brief description of the mechanism may be given, in view of the fact that, while the principle remains the same as was originally presented in the patent specification, the mechanism has been since shorn of its superfluous details. This is a description in brief of the modified mechanism of the attachment as supplied by Mr. Hibberd:

The coin-freeing mechanism controls a driving vertical spindle engaging the gas-meter's index-driving column, and follows the travel of the ordinary index mechanism. The driving spindle is fitted either with a pinion or bevelled wheel, which engages with a spur wheel working on to another tooth wheel, which is fixed to the top of a plain upright column, on which is mounted a wormed wheel free to rise and fall. This wormed wheel is fitted with a guiding-pin running in a slot the length of the column. The wormed wheel is always engaged with a screwed column alongside the plain upright column. The gas, in flowing out, sets in motion the driving vertical spindle, which rotates the plain upright column; and this action causes the wormed wheel to descend proportionately to the value of the delivery. On reaching the end of its travel, it engages a lever, which lever engages an arm attached to the valve. On depressing the end of the lever, the valve is closed, and the supply cut off. The coin in passing through the slot engages arms which separate the different values. The coin being delivered to its particular travel falls into a receptacle at the end of a lever. This lever is practically a balance. On the end of the lever is a stem designed in form to operate as a stop on the mechanism which drives a wormed column; the stop being removed when the coin passes to the cash-box. On the handle being turned, the controlling stop-wheel governs the revolutions of the wormed column, and brings the wormed wheel into the position which determines the regulated delivery proportional to the value of the coin inserted.

That describes the mechanism and how it is actuated and enters into combination with the measuring mechanism in performing the joint duty of receiving coin and delivering gas.

There is only one slot to the meter for all the coins; and though it will not do to tell the consumers this, the attachment is effective even when bent or flattened coins are used. On the right-hand side of the attachment, it will be observed there is an indicator up and down which a small pointer travels, and next to it is a handle. The consumer requires a pennyworth of gas, he does not happen to have a penny in the house, but has two halfpennies. He drops one halfpenny in the slot, the handle remains locked; he drops a second halfpenny in, the handle can be turned, and the pointer of the indicator rises one mark, and the gas supplier is indebted to the consumer for a pennyworth of gas. The consumer has not a penny or two halfpennies, but he has a threepenny piece. He drops that into the slot, the pointer of the indicator rises three marks. He has a sixpence, or a shilling, he drops one or the other in the slot, and the pointer rises six or twelve marks as the case may be. He may be a consumer who likes to have a stock of gas to his credit. He is at liberty to pay for anything from 1d. up to 5s. at one time. The descent of the pointer shows him how much he has still to his credit as the consumption proceeds; and he can at any time supplement the amount of his credit by pennies and the three silver coins, or any one or all of them. It is a prepayment attachment with a big range of convenience in service (as we have said) both for the gas consumer and the supplier. It should perhaps be mentioned that the attachment seen on the occasion of our inspection was made for payments by the insertion of combinations of the coins named up to 2s. 6d. There are three important matters that were pointed out, but have not yet been noticed. They are: In the event of any multiple of the coins named being inserted in the meter without turning the handle, the mechanism will not suffer injury, neither will the directing ways be blocked. It is impossible for the mechanism to be manipulated so as to obtain a supply in excess of the prepaid quantity; and provision has been made for changing the amount of gas to suit variations in price.

It is intended to supply the meter and attachment together, or the attachment alone for the conversion of ordinary meters. Mr. Hibberd demonstrated how readily the ordinary wet or dry meter can be converted to this system of prepayment. The new attachment cannot, of course, affect the large number of prepayment meters already installed, until perhaps the time arrives when repair is needed. But if this new attachment proves itself in daily use to be all that a short acquaintance suggests that it is, then many gas engineers will be very desirous of installing such a convenience in future—the fixing of new prepayment gas-meters shows no abatement yet—and utilizing it as frequently as occasion permits. There can be no doubt that, from many points of view, a multi-coin prepayment meter rises superior to the mono-coin type; and it is therefore an advance, and supplies something of which the prepayment system has hitherto been deficient. Mr. Hibberd may be congratulated on the interesting and ingenious outcome of his diligent and skilful tackling of an awkward problem.

Trade Union Tyranny.—Such a case as that dealt with at the South Shields County Court last Thursday, says the "Pall Mall Gazette," is an ample excuse for the existence of what is known as the Free Labour Association. The plaintiff, Conway, who is a member of the Labourers' Union, had neglected to pay a fine of 10s. to that Union eight years ago; and for this great crime the firm he served was required to part with his services to prevent a strike. Other firms to which the victim applied refused to employ him because they feared the disturbance which his presence would create. The case shows that a Trade Union may become mercilessly tyrannical; and Conway was indifferently compensated by £50 damages. The right of Unions to maintain discipline among their members is not questioned; but they carry matters too far when they destroy a man's chances of earning his living to punish him for some breach of their rules. It is incumbent upon them to recognize that such a punishment is excessive, and that it attacks the principle of individual liberty; for if a man must obey the Union or face starvation, he becomes the most hopeless kind of slave. It is quite enough for a Union to expel anyone who breaks its rule; to pursue him vindictively afterwards is a crime.

CHEMICAL CHANGES OCCURRING DURING CARBONIZATION IN HORIZONTAL, INCLINED, AND VERTICAL RETORTS.

By HAROLD G. COLMAN, Ph.D., M.Sc.

[A Lecture delivered before the Manchester and District Junior Gas Association, Saturday, Nov. 23.]

On thinking over the question of a subject for the lecture your Committee kindly asked me to give to this Association, it appeared to me that it might be advantageous to devote the time to some considerations having a bearing on one of the most important questions now before the gas industry—namely, the carbonization of coal in vertical retorts. The time available does not, of course, allow of an exhaustive treatment of the subject in all its relationships, whether of a chemical, engineering, or commercial nature. I propose, therefore, to confine myself, in the first place, to a general consideration of the chemical changes occurring in the carbonization, and, in the second place, to the manner in which these changes are modified, according as the carbonization is carried out in horizontal, inclined, or vertical retorts. Originally, I hoped to extend the discussion to the question of carbonization of the coal in larger bulk, as in coke-ovens; but I soon found that it would be impossible and inadvisable to do this within the limits of a single lecture.

As you are all aware, the changes which take place when coal is heated in the absence of air, are of an extraordinarily complicated nature, and result in the formation of hundreds of different compounds—some solid, some liquid, and some gaseous at the ordinary temperature; and at present we are far from possessing a complete knowledge of the exact manner in which the formation of these numerous substances takes place. Nevertheless, though such detailed understanding is by no means achieved, the knowledge gained during the past hundred years, both in the laboratory and in the practical working of carbonization on the large scale, has enabled us to come to certain general conclusions which are of the very highest importance to gas-makers—*i.e.*, to those whose first object is to obtain from a given amount of coal the maximum quantity of gas of suitable heating and illuminating power for general distribution as a source of light, heat, and power.

The essential constituents of coal are carbon, hydrogen, and oxygen, and, in addition, the elements nitrogen and sulphur are always present in smaller quantity, as well as a varying quantity of mineral matter, which is left behind as ash when the coal is completely burnt. As an example of the composition, an analysis is here given of a sample of Derbyshire gas coal of good quality, and containing only a low percentage of ash and sulphur.

Carbon	79·85 per cent.
Hydrogen	4·84 ,,
Oxygen	10·96 ,,
Nitrogen	1·23 ,,
Sulphur	0·72 ,,
Ash	2·40 ,,

The percentage of the constituents naturally varies to a considerable extent in the different varieties of coal.

In considering the action of heat on such a coal, it will be convenient to deal first of all with the carbon and hydrogen only—these being the most important constituents from a gas-maker's point of view; leaving the discussion of the changes taking place with regard to the other constituents until later. When the coal is heated in the absence of air, it splits up into two portions—(1) a solid non-volatile portion, which remains in the retort as coke, and (2) a volatile portion, partly liquid and partly gaseous at the ordinary temperature—tar and gas. It is an invariable rule that the volatile portion contains a larger percentage of hydrogen and a lower percentage of carbon than the original coal, and that exactly the reverse is the case with the solid residue. When the temperature employed is the lowest at which decomposition of the coal takes place, which is well below a red heat, it is found that the volatile portion consists mainly of hydrocarbons which are liquid at the ordinary temperature, and that, working under these conditions, only a small yield of rich gas is obtained, consisting mainly of marsh gas (CH_4) and ethylene (C_2H_4) with smaller quantities of hydrogen, and that a large quantity of tar is formed; the latter consisting, for the most part, of liquid hydrocarbons of the paraffin and olefine series, which have the composition represented by the general formulæ C_nH_{2n+2} and C_nH_{2n}—*i.e.*, of substances which contain at least twice as many hydrogen atoms as carbon atoms in the molecule. The tar thus obtained is, in fact, closely similar to the naturally occurring petroleum oil, which has probably been produced in a somewhat analogous manner by the distillation of organic matter beneath the earth's surface. The residue of coke obtained at such temperatures still contains large quantities of hydrogen which can be driven off by further heating; and this residue is a twin-brother of the much discussed "Coalite."

Where it is desired to obtain a residue of this kind still containing hydrogen, or where the object is to manufacture hydrocarbons like petroleum from the coal, as in the Scotch shale-oil industry, the employment of such low temperatures is favourable; but for gas-making purposes it is obvious that these are useless, and that higher temperatures must be employed. When the retort is heated to a greater extent, the coal only rises in temperature gradually, and first it undergoes the above low temperature decomposition. But the further action of heat brings about new decompositions, both in the above hydrogen containing residue and in the volatile matter first produced; and although these changes take place simultaneously, we may, for convenience, consider them separately.

The effect of greater heat on the low-temperature coke is to decompose it further and to drive off additional quantities of hydrogen, which at this temperature is evolved chiefly as marsh gas, and in the elementary condition; so that the product now formed by the further decomposition of the residue is chiefly a permanent gas. At moderate temperatures—about a dull red heat—a considerable additional amount of hydrogen is thus driven off, and the coke becomes harder and denser. But even then the hydrogen is far from completely eliminated. A further increase of the temperature to the highest attainable in practice results in the evolution of still further quantities of gas, which also consist mainly of marsh gas and hydrogen. But as the temperature rises, so the percentage of marsh gas in the gas given off rapidly decreases, while that of free hydrogen increases; and the coke simultaneously tends to become still harder and denser. It will be seen, therefore, that the higher the temperature to which the coal is finally heated, the greater is the yield of combustible gas which is obtained from it.

Now let us turn to the further action of heat on the volatile products. We have seen that while the coal is only at a low temperature during the process of heating, it is giving off petroleum-like hydrocarbons, which are useless to the gasmaker. When the retort is more highly heated, these petroleum-like products undergo further decomposition if subjected to this higher heat before they can pass out of the retort, and at temperatures rather above a red-heat split up, yielding a still more volatile portion, consisting of substances which are gases at the ordinary temperature. The most important of these are hydrogen, marsh gas, ethylene, and benzene. The latter, it is true, is a liquid at the ordinary temperature, but is so volatile that the great bulk of it is retained in the gas.

On the other hand, simultaneously with the formation of these gases, the petroleum hydrocarbons yield many substances less volatile than themselves, consisting of hydrocarbons of the "aromatic" series—such as benzene, naphthalene, and anthracene derivatives—which contain a much higher percentage of carbon and a lower percentage of hydrogen than the petroleum hydrocarbons from which they are formed. These are liquids at the ordinary temperature, or if solid (like naphthalene and anthracene) are soluble in the other liquids, and condense together as a fairly thin tar in the subsequent cooling of the gas. By subjecting the volatile products to such a temperature, therefore, the yield of permanent gas from them is greatly increased, and that of tar diminished; and the tar itself consists of a different series of hydrocarbons, which are of especial value for the coal-tar industry, although, owing to the fact that these are now produced in quantities exceeding the demand, the commercial value of them to the gas manufacturer has greatly diminished.

If, however, the volatile products are subjected to the action of still higher temperatures before leaving the retort, such as a bright red or white heat, further decompositions take place, which, on the whole, are by no means favourable to the production of gas. The tar vapours of the aromatic series undergo further decomposition into still denser hydrocarbons and a gas consisting mainly of hydrogen, and many of the new hydrocarbons formed are solid, even at a red heat, and quite insoluble in the other tar. These are partly deposited on the heated walls, as "carbon" or "scurf," and partly carried out of the retort with the hot gas as finely divided solid particles, and separate on cooling with the tar, making it much more viscous, even when hot. Moreover, the true gaseous products themselves at this temperature undergo further decompositions; the benzene vapour being converted into hydrogen and substances which condense in the tar, while the ethylene yields hydrogen, marsh gas, and tarry matter. Even the marsh gas, which is the most stable of the gaseous hydrocarbons, undergoes partial conversion into hydrogen and tarry matters, and perhaps free carbon.

It appears, therefore, from these considerations, that, while in order to obtain the maximum yield of gas from coal it is advisable to subject the latter finally to as high a temperature as possible in order to drive off the maximum quantity of volatile matter from the coal, the gases and vapours produced in the distillation should only be subjected to a considerably lower temperature than that to which the coke is eventually heated, as too high a temperature results in the deposition of carbon which would otherwise have remained in the gas, and which is deposited either in the retort or in the tar—thus depreciating both the calorific and the illuminating power of the gas. On the other hand, it is equally evident that these volatile products must not be exposed to too low a temperature, for in that case the liquid hydrocarbons produced in the early stages of distillation would

not be sufficiently decomposed, and would be largely lost from a gas-making point of view—being condensed in the tar.

Now let us turn to the fate of the other constituents of the coal during carbonization—the oxygen, nitrogen, and sulphur. The ash, of course, all remains in the coke, and need not be further considered. Oxygen is contained in the coal in large quantity, and a considerable proportion of it is present, either as free moisture, or as water in loose combination with the coal, which is driven off at very low temperatures. The other volatile products formed in the initial stages from the coal contain compounds of carbon, hydrogen, and oxygen, which on further heating are decomposed, forming water vapour, carbonic acid, and carbonic oxide. As the temperature is still further raised, the carbonic acid tends to combine more and more with the red-hot carbon present, undergoing reduction to carbonic oxide. The water vapour present also acts on the hot carbon, forming hydrogen, carbonic acid, and carbonic oxide, according to the familiar water-gas reaction; and the higher the temperature the greater is the proportion of carbonic oxide which is formed in this manner, and the higher the quantity of steam which is thus converted into permanent gases. A small quantity of oxygen is always found in combination with carbon and hydrogen in tar; but, roughly, three-quarters of the oxygen is obtained from the gas as water on cooling, and about a quarter remains in the gas as carbonic acid and carbonic oxide.

When the coal is heated, the effect on the nitrogen is very similar to that on the hydrogen. At very low temperatures this element is evolved largely in combination with carbon and hydrogen as substances which are liquid at the ordinary temperature and condense in the tar—only small quantities of ammonia being formed; while a large proportion of the nitrogen remains in the residual coke. At higher, but still moderate, temperatures, much more nitrogen is given off from the coal, and the original volatile products are decomposed, forming ammonia, the maximum yield of which is obtained at such temperatures. At very high temperatures, although still more nitrogen is given off from the coke, the ammonia produced is now itself largely decomposed into its elements nitrogen and hydrogen by the heat, and some of it also acts upon the red-hot carbon of the coke, yielding hydrocyanic acid. So that, in spite of the greater elimination of nitrogen from the coke, the yield of ammonia is decreased. Some of the nitrogen is also found in the tar—chiefly in the form of nitrogenous bases, such as pyridine. The sulphur, too, in all probability, comes off at low temperatures as compounds of sulphur with hydrogen and carbon, which, when more strongly heated, are further decomposed, yielding sulphuretted hydrogen, which can be removed from the gas without great difficulty. At still higher temperatures, the decomposition takes place with formation of carbon bisulphide. This substance is also produced at high temperatures from the sulphur still remaining in the coke, and thus increases the amount of those sulphur compounds which can only be removed with great difficulty.

Both as regards nitrogen and sulphur, therefore, as with the hydrocarbons, it is desirable that the volatile products themselves shall only be heated to a moderate temperature if a maximum yield of ammonia is to be obtained and a minimum quantity of carbon bisulphide produced. In the case of the oxygen compounds alone is there any advantage obtained by subjecting the products to a very high temperature, owing to the greater proportion of carbonic oxide and the smaller proportion of carbonic acid thus produced, and the larger quantity of steam converted into combustible gas. On the whole, however, there can, I think, be no doubt that the slight advantage gained in the latter respect is far more than counterbalanced by the deleterious action of such high temperature so far as the hydrocarbons, nitrogen, and sulphur compounds are concerned.

Having thus considered in general outline the nature of the chemical changes which take place when coal is distilled, let us now follow the well-known advice of Mr. Newbigging, to project ourselves inside the retort, and, using these considerations as our guide, endeavour to ascertain how far the best conditions are maintained in the various types of retort now in use, and also in what manner the changes taking place are modified by the differences in construction and methods of working.

Except during the very early stages of the gas industry, and again during the past few years, carbonization has been almost universally carried out in gas-works in long, narrow retorts set horizontally or at an angle of about 32° to the horizontal, into which the coal is charged all at once in such a manner as to cover fairly evenly the whole of the bottom of the retort, and to leave a free space above the coal throughout its full length, through which the gases produced must pass before they can reach the ascension-pipe. In the main, the nature and sequence of the chemical changes are identical in both the horizontal and inclined settings. The carbonization of the coal commences on the outside of the mass—namely, at the bottom and sides—where it is in contact with the hot walls of the retort, and also on the top, where it is affected by the heat radiated through the free space from the heated crown of the retort, and as time goes on the heat slowly penetrates from the circumference to the centre of the coal. The vapours first given off are, as already mentioned, low-temperature products of a similar character to petroleum. Those formed at or near the circumference readily get away from contact with the coal into the vacant space above; but here they are subjected to the further action of heat in two ways. In the first place, they come in contact with the hot walls of the retort, and, in the second place, they are bombarded, so to speak, by the heat rays which are constantly traversing the free space. The action of these two forms of heat, as pointed out frequently by the late Mr. William Young is not quite the same, inasmuch as the former acts fairly equally on all the constituents of the gas, whereas the latter exerts a selective action and effects the decomposition of certain constituents of the gas more readily than others.

Time will not allow of a further discussion on this point now; but it will be found fully discussed in Mr. Young's papers. For our present purpose, it is sufficient to note that, by the combined action of these two forms of heat, the vapours originally produced from the outer layers of the coal are subjected to considerable heat before they escape from the retort, and that the higher the temperature to which the retort is heated, the greater must be the decomposition they undergo. In addition to the temperature, there are other factors which influence the extent to which the gases are decomposed in their passage through the free space, such as the size of the charge, the pressure in the retorts (especially the extent to which this pressure undergoes variation), and the number of outlets from the retort available for the gas. Here again, however, time will not permit of a consideration of these points to-day; and I must content myself with this bare reference to them, and confine the consideration to the effects of temperature alone.

As the heat penetrates the mass of coal in the retort, the same petroleum-like vapours are given off first; but before these can reach the free space above the coal, they must pass through the hot outer layers of partly carbonized coke, which is now itself giving off chiefly permanent gases, such as marsh gas and hydrogen. The petroleum-like primary products given off during the later stages of the distillation have therefore not only to undergo the action of heat in the free space above the coal, but, before reaching this, must also pass over a surface of heated coke, the temperature and area of which constantly increase as carbonization proceeds. In consequence of this, the quality of the gas produced falls very greatly from nearly the beginning to the end of the charge, as is readily seen from the accompanying table, which shows the composition of the gas evolved at different periods in the carbonization of a good Derbyshire coal in a horizontal retort at a temperature of about 1750° Fahr. It will be seen that the percentages of sulphuretted hydrogen, carbonic acid, ethylene, benzene, and marsh gas steadily diminish as time progresses, while that of hydrogen as constantly increases; the amount of carbonic oxide alone remaining fairly constant.

Composition of Gas Produced at Different Stages in Carbonization in Horizontal Retorts.

Hours after Commencement.	½ Hour.	1½ Hours.	2½ Hours.	3½ Hours.	5 Hours.
Sulphuretted hydrogen. . .	3·8	3·1	2·8	2·1	1·2
Carbonic acid.	3·0	2·8	2·6	2·3	1·7
Ethylene and benzene . . .	8·7	5·2	3·6	2·4	0·0
Oxygen	0·0	0·0	0·0	0·0	trace
Carbonic oxide	4·3	5·0	4·9	4·5	3·8
Hydrogen	29·8	37·5	42·2	46·2	60·8
Marsh gas	49·7	42·0	39·4	37·5	26·3
Nitrogen (difference) . . .	0·7	4·4	4·5	5·0	6·2

When the manufacture of coal gas was first introduced, and especially before the introduction of gaseous firing, the retort temperatures attained in practice were usually not much over 1600° Fahr. Under these conditions the volatile products were not very materially overheated, and gas of good quality was obtained; while the tar produced was sufficiently thin to flow without difficulty, and contained only small amounts of the objectionable "free carbon." At the same time, the amount of naphthalene produced was not excessive; and the quantity of "light tar oils" simultaneously formed was sufficient to wash the naphthalene out of the gas fairly completely during condensation. On the other hand, the make of gas per ton at these temperatures was relatively low, as a considerable amount of volatile matter was left in the coke.

When, with the aid of gaseous firing, higher temperatures of carbonization were employed, matters were greatly modified, as the volatile matter in the coal was more completely given off, and a much better yield of gas obtained. But, as we have seen, it follows inevitably that in a horizontal or inclined retort having a free space above the coal, the volatile products must also be more strongly heated by an increase of temperature of the retort; and as a result of this we find that the gases and vapours are now more completely decomposed than they were under the old conditions, causing a reduction in the quality of the gas produced, as some of the carbon which was previously obtained in the form of hydrocarbons in the gas is now deposited as solid or liquid products, which either remain in the retort as carbon or are condensed with the tar and lost from a gas-making point of view. Simultaneously, other disadvantageous changes occur, inasmuch as the tar formed is much thicker, thereby increasing the trouble from stopped ascension pipes and pitched hydraulic mains, and thus adding to the difficulties of practical retort-house working. Further, the action of these higher temperatures results in the formation of larger quantities of naphthalene and smaller quantities of light-tar oils, bringing about the advent of the naphthalene difficulty.

In spite of these drawbacks, the maintenance of higher tem-

peratures has, on the whole, proved favourable, for although loss of carbon from the original volatile products takes place, and a lower quality of gas containing more hydrogen is produced, and the troubles in the above-mentioned respects are greatly aggravated, the increased yield of gas obtained by the more complete distillation of the volatile products from the residual coke has more than counterbalanced these disadvantages, especially in view of the fact that nowadays, owing to the introduction of the incandescent burner, a high illuminating power of the gas supply is no longer necessary. But even if it be admitted that in the employment of higher temperatures with these retorts the advantages outbalance the disadvantages, this does not form a satisfactory final solution of the problem of carbonization. What must be aimed at is a method whereby the coal can be finally heated to a very high temperature without simultaneously causing too great heating of the gases and vapours produced. From what has been said, it is evident that this is impossible with the existing arrangements in horizontal and inclined retorts having a free space above the coal; and that for this purpose a radical departure must be made from existing procedure. It is the desire to attain this end which during the past few years has led several investigators to the adoption of the vertical retort; and in the time remaining at my disposal I propose to consider the manner in which the chemical changes are modified in such retorts.

At the present time two different types of vertical retort are being tried. The first is the discontinuous type, in which, as in horizontal retorts, the coal is charged all at once into the retort and the coke discharged when the whole is completely carbonized; the second is the continuous type, in which the coal is regularly fed into the top of the retort in small charges, and the coke is removed more or less continuously from the bottom. Of the first class there are at work two examples—the vertical retort devised and brought into practical working by Dr. Bueb in Germany, and the system being tried by Mr. Love, at Guildford, of retorts set at an angle of 45°. These latter are, of course, not truly vertical retorts; but in the main they may be classed with them, as, owing to their steepness, the retort, except at the extreme top, always remains full of coal, and the sequence of chemical changes is the same as in truly vertical retorts. The Bueb retort is as yet the only vertical retort of any type which has been at all widely adopted; and its use is rapidly extending, especially in the country of its origin.

In the first method of construction adopted by Dr. Bueb, he endeavoured to attain the desired end, of avoiding too great an action of heat on the gases produced, by employing a rectangular vertical retort which was only heated on three sides, while on the fourth unheated side ports were built at different heights to enable the gas produced to pass at once into a conduit, by which it was led away to the hydraulic main without becoming strongly heated. Of the results obtained with this form of retort, no details have been published; but experiments made with it led Dr. Bueb to the highly important discovery that the provision of these ports was unnecessary, as he found that in a vertical retort full of coal and heated on all sides, the gases produced, instead of passing through the hot coke layers on the periphery of the retort, find their easiest way out of the retort through the interior comparatively cool core of uncarbonized coal, by means of which they make their way to the top of the retort, and thence (through the ascension-pipe) to the hydraulic main. The carbonization of the coal, as in horizontal retorts, takes place from the circumference to the centre of the charge throughout the whole length of the retort; but owing to the abolition of the free space (except a small amount at the extreme top), the gases produced as carbonization proceeds no longer have to find to their way through the highly-heated outer layers of coke or to travel along the hot crown, but are able to escape through the coolest portion of the mass. In this manner they escape the excessive decomposition they receive in a highly-heated horizontal retort; while at the same time the desired end of a final high temperature of the coke is attained.

The result of this is that while the make of gas per ton is at least as high as it is with horizontal retorts, the quality of the gas produced, and in particular its calorific power, is decidedly higher, inasmuch as the permanent hydrocarbon gases produced at moderate temperatures (more especially the ethylene and, to a lesser extent, the marsh gas) are no longer broken up with deposition of part of their carbon. Simultaneously, owing to the lower temperature to which the gases are exposed, the tar produced is now a comparatively thin oil, containing very little suspended "free carbon," and brings about no serious trouble in the way of stopped pipes and pitched hydraulic-mains. Further, in spite of the high make per ton, the amount of naphthalene is lower and that of light oils higher; and these latter are sufficient in quantity to effect a fairly complete removal of the naphthalene from the gas during condensation. Moreover, in these retorts the ammonia, as well as the hydrocarbons, is protected from excessive heat, and is therefore decomposed to a smaller extent into its elements, or into hydrocyanic acid by the action of the hot coke; so that an increased yield of ammonia of some 40 per cent. is said to be obtained, and it is stated also that the amount of gaseous sulphur compounds produced, other than sulphuretted hydrogen, is greatly diminished. The coke formed, too, is harder and much denser (more like the coke produced in coke ovens), owing to the fact that in a vertical retort the coal during carbonization is, by its own weight, subjected to a much greater pressure than is the case in the ordinary horizontal and inclined retorts.

One disadvantage of the full retort, however, lies in the fact that, although the gas finds its easiest way through the core, the passage is by no means an unobstructed one, as the interstices between the larger pieces of coal are partly blocked by the dust and small always present when crushed coal is used; and consequently the pressure of the gas required to force its way out is rather high, especially at the bottom of the retort. This difficulty appears to have been to a large extent overcome by a very ingenious, yet simple, device due to Herr Ernst Körting, of Berlin. By his plan, instead of charging the crushed coal directly into the retort, it is first passed through a screen and divided into nuts and small. These are then charged into the retort simultaneously but separately. In this manner the stream of nuts lies largely separate throughout the retort, and forms relatively easy channels by means of which the gas finds its way to and through the central core, whereby the excessive pressure at the bottom of the retort is greatly diminished.

In Mr. Love's 45° retorts now in use at Guildford, practically the same sequence of reactions occurs as in the Bueb retort, inasmuch as the retort is always full of coal except at the extreme top; and the gas finds its way out through the central core. In like manner, a high yield of gas of good quality is obtained, with simultaneous production of a thin tar, a higher yield of ammonia, and a harder and denser coke.

Of the second type of continuous vertical retorts, three examples have been, or are about to be, tried in this country—namely, the Settle-Padfield, the Woodall-Duckham, and the Young-Glover installations. These, so far as the principles of carbonization under discussion are concerned, are in the main identical. In all three forms the retort is kept full, or nearly full, of coal; but instead of the charge being introduced all at once, it is put in at the top in small quantities at short intervals—the coke being removed in a similar manner at the bottom. Thus the retort is never emptied in ordinary working; and the chemical changes going on are always approximately the same, instead of varying according to the length of time the charge has been in the retort, as is the case with discontinuous charging. Hence the gas given off is much more nearly of uniform quality. Working in this manner, the coal increases in temperature as it passes downwards through the retort, so that the low-temperature petroleum-like products are all given off only in the upper portion of the retort. At this point the temperature within the retort is comparatively cool, inasmuch as, however highly the walls of the retort are heated, the incoming cold coal keeps the temperature down in the interior of the retort; and the outlet for the gas being at the top, these products get away without being overheated. As the partially carbonized coal gradually passes down the retort, it gives off permanent gases, which, as they ascend on their way out of the retort, constantly get into cooler and cooler regions, and simultaneously assist in driving out of the retort the more easily decomposable volatile products produced above them.

It will be seen, therefore, that, although there are differences in the manner in which the reactions of carbonization take place in the continuous and discontinuous vertical retorts, there is no such wide distinction between what occurs within them as there is between that taking place in the ordinary horizontal or inclined retorts with a free space above the coal, and in all forms of vertical or fully-charged retorts. There can, I think, be no question that in all the fully-charged types the ideal course of procedure is far more nearly approached than with the ordinary horizontal or inclined types, and that in them, while it is possible to drive out the maximum amount of volatile gas from the coke, excessive overheating of the volatile products themselves can be avoided, resulting in the production of gas of higher quality, more ammonia, and a thinner tar free from suspended matter, which does not interfere with the proper and easy working of the carbonization plant. The relative advantages which will decide in favour of continuous or discontinuous retorts will be, I consider, not so much of a chemical as of an engineering or commercial nature.

We have seen, however, that while the exposure of the gases to an excessive temperature must be avoided, it is also disadvantageous, from a gas-making standpoint, if they are insufficiently heated; and the question naturally arises whether in some or all of the vertical retort systems, it may happen that the original vapours are not sufficiently heated to yield the maximum quantity of gas they are capable of producing. On this point opinions are at present divided. Messrs. Young and Glover believe that such is the case, and are therefore providing a special chamber above the retort where these products can be subjected especially to the action of radiant heat; while Messrs. Woodall and Duckham believe that this procedure is unnecessary. At the present time the evidence available is insufficient to permit of a definite conclusion on the point; but it seems to me that whether the additional heating is necessary or not will depend upon the relative temperature at the top of the retort, and on the nature of the coal carbonized. Thus in the Woodall-Duckham retorts the highest temperature is maintained at the top, and in the Young-Glover installation at the bottom, which may materially influence matters. It is also not unlikely that coals rich in hydrogen, such as many of the Lancashire and Yorkshire varieties, might require such additional heating of the gas, which would be unnecessary with gas derived from coals poorer in hydrogen, such as those from the Durham coalfields.

Before concluding, there are one or two cautions I should like to give. In this lecture I have tried to put before you, as far as time permitted, the state of present knowledge with regard

to the chemical reactions taking place in carbonization; and I have endeavoured to confine myself to what I believe to be facts, or what appear to me to be reasonable deductions from those facts. I do not, however, wish you to go away with the idea that what I have said covers anything like the whole of the ground even from a chemical point of view, and still less do I wish you to accept the conclusions I have given voice to without examination on your part to see if they fit in with your own experience of the facts; for undoubtedly further work, and a fuller knowledge of the facts, may, and probably will, necessitate some modification in many of the views expressed.

Moreover, it has been necessary for me to confine myself almost exclusively to the consideration of the chemical and physical principles of carbonization; and although these are of the utmost importance, and a knowledge of them essential in order to obtain the best possible results, it must be borne in mind that this information, taken by itself, would be of little use in the practical working out of the process on a commercial scale. Here other conditions of equal or even greater importance must be considered—namely, the engineering principles involved in giving effect to those chemical reactions in the best possible way, and the economical and commercial principles involved in carrying out the process at the lowest cost. Often a procedure which would be advantageous from a chemical standpoint is counterbalanced by greater disadvantages from engineering or commercial considerations, or *vice versâ;* and the best results in any process can only be obtained by the full and simultaneous study of all three sides, and neglect of any one of them must result in a lessened degree of success.

To most of us it happens that one particular side has more attractions than the others; and we are all apt at times rather to exaggerate the importance of that which interests us most and to minimize the considerations which appeal to our imaginations less strongly. If, one and all, we are on our guard against this latter tendency, and recognizing that, in gas manufacture as in other technical processes, the fullest degree of success can only be gained by all three sides pulling together in harmony towards the goal, instead of against each other, there will be little doubt of the continued success and further expansion of the gas industry in the future, in which success many of you, junior members of the profession, will, I have no doubt, fully bear your share.

The lecturer received quite an ovation at the close of his address; and the President (Mr. E. J. Wellens), who occupied the chair, expressed the interest he had felt in the lecture, and invited discussion or questions, which he said Dr. Colman would be pleased to answer.

Mr. S. Glover (St. Helens) said the lecturer had helped them very much by projecting them in imagination into the inside of a retort. The subject of the lecture had been one which he had studied for many years—in fact, before anything on the advanced scale treated that afternoon had been published. For a very long time past, he had been dissatisfied with the method of carbonization as carried on generally. It was what he might term a haphazard method, which he had often criticized, and was anxious to amend. The lecturer had not gone as deeply into the questions and results of the higher temperatures as he could have wished. The point to get at was no doubt the breaking-up of the constituents of coal into the order in which Nature had welded them together. At present large quantities of coal could not be so well treated as small amounts. The importance of raising the heat had not yet been sufficiently realized. Then there were differences in the quality of coal to be dealt with. They should have power to control the heat in various parts of the retort.

Mr. D. V. Hollingworth (Salford) said they in the North were looking to such men as the lecturer for guidance. They had derived great benefit from Dr. Colman's writings. In the general methods of combustion, he thought they in this part of the country were distinctly stupid in carbonizing coal, as it were, in a drain—for it was more like a drain than anything else. If engineers gave more attention to the subject of charging retorts, he thought better results would be obtained. They were all agreed on several points brought forward by the lecturer in the matter of heat. Why could they not have continuous charging on a highly-heated surface? He did not think certain difficulties under which they laboured were insurmountable.

Mr. H. Kendrick (Stretford) remarked that members of the Senior Association would have an opportunity on Saturday next of seeing vertical retorts in operation, and would be able to compare some of the results. He thought they were able to derive much information and great advantages from the different kinds of retorts now in use. Their knowledge had been increased by Dr. Colman's lecture.

Mr. J. Alsop said he had taken great interest in all that the lecturer had said; and he hoped to have the opportunity ere long to see vertical retorts in operation.

Mr. T. Glover (Norwich) said that, being in Manchester, and hearing of the lecture, he had been pleased to attend, and show his interest in the subject. He had heard a great deal, and read a great deal, of the doings of the Manchester and District Junior Gas Association; but this was the first meeting at which he had had the privilege of being present. In the Eastern Counties, where he was living, towns were wide apart; and he was afraid that the young men there, who were expecting to be managers some day, had very poor advantages compared with those in Manchester. He had admired the young men in the Manchester district, and also in the Midlands, for their enterprise and spirit. He regarded it as a happy idea on their part to invite Dr. Colman to come and discuss theory with them. They had not, he thought, studied the subject of charging retorts as they ought to have done—especially in the matter of the reaction going on in the retorts. They had carried on their work very much in a rough, hap-hazard, and unscientific manner. They should arrive at the best knowledge they were able to attain on the subject, and get at the highest value from a given weight of coal, and make their machinery suitable for it. So far as they had gone, results seemed in favour of the vertical retort. The systems in use on the Continent must be tested here; it was not easy to go to Germany to see them working. They could not satisfy themselves so well as if the methods were tried in this country. After a while, we in England might get something better even than Germany in our methods of carbonization. The London Companies were finding great advantages in using an extremely high temperature for carbonization. It had resulted in greatly increased carbon bisulphide constituents, and in a reduced production of ammonia.

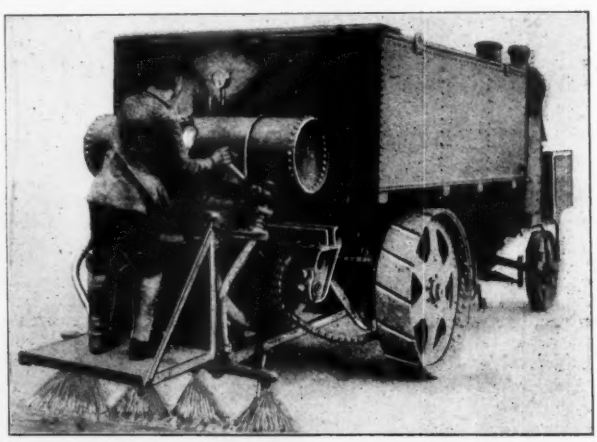
Dr. Colman, in the course of a brief reply, said the subject was after all in the experimental stage; and in ten years from now they would make further discoveries. He appealed to members of the Association to secure retorts which they believed would produce the best results, and let those results be known.

On the motion of Mr. Thorp, seconded by Mr. Teesdale, a hearty vote of thanks for his lecture was accorded to Dr. Colman; and with his acknowledgment, the meeting terminated.

THE AITKEN PRIZE TAR-SPRAYER.

All tar sprayers do not, of course, give equal satisfaction; and makers or users almost invariably lay the blame on the tar. Certain it is that the quality of the tar is an important factor in this class of work. Tar insufficiently distilled is unsuitable, and in many cases leads to failure; and if the process of distillation is pushed too far, the result may be equally unsatisfactory.

The £100 prize-winning patent pneumatic tar-sprayer invented by Mr. Thomas Aitken, Road Surveyor, Cupar, Fife, is here shown. It was selected by the Roads Improvement Association as the best in practice; and they awarded him the gold medal. It can discharge tar in a hot or cold state. The patent spraying apparatus can be attached to an ordinary horse water-cart, or a water-van drawn by a motor; but the best results are obtained by using steam-waggons which have a large-tank capacity, and



ample power to drive the mechanism and ascend steep gradients. The surface treated may vary; but the most satisfactory width is 6 feet. The apparatus has, besides the necessary arrangements for pumping air and tar, an air-receiver situated between the tank holding the tar and the distributing pipe. In the first instance, air is pumped into this receiver, until the pressure-gauge registers fully 100 lbs. The air-valve is then closed; and tar is pumped into the receiver until a pressure of from 150 to 225 lbs. per square inch is attained—depending on the temperature of the atmosphere. Work can then be started with the forward motion of the waggon; and when in operation the valve admitting the tar into the receiver is regulated according to the quantity required to be sprayed on to the road.

In repairing macadamized roads, tar is made use of as a matrix along with a small proportion of whin chips and dust. Two or more applications are necessary in order to ensure that the surfaces of all the stones will be covered by a film of tar—about 6 gallons of tar being allowed to each ton of metalling used. It is necessary to employ refined tar, and the tarring must be carried out in fine weather. Tar, of course, possesses powerful disinfectant qualities, and gives the road an impervious coating. There is, too, no rubbing of the stones one on another under traffic, Dust and mud are thus eliminated.

SOCIETY OF BRITISH GAS INDUSTRIES.

A good attendance of members was supplemented by several friends of the gas profession at the Annual Meeting of the Society last Thursday, at the Holborn Restaurant, when the PRESIDENT (Mr. Dugald Clerk, M.Inst.C.E., F.C.S.) was in the chair.

RAILWAY RATES AND CO-OPERATION BY ARCHITECTS.

In opening the proceedings,

Mr. CHARLES CLARE (Chairman of the Council) remarked that, at the autumn meeting of the Society, it was not customary to go through any special *agenda*, but there were two items before the Council that he should like to mention. The first was that of railway rates. The members would perhaps remember that one of the objects of the Society was to obtain more favourable terms and rates from railway and shipping companies and other carriers of goods. One of the Sections had already availed themselves of the clause in the objects by asking to be received by the Clearing House and the railway companies; and the Clearing House had already agreed to receive a deputation under the auspices of the Society. There were other sections which were probably affected in the same way; and the Council would be very glad if they would bear the subject in mind, as it was considered one of importance. The other point was that it was hoped by the Council that there would be a conference in the spring with the architects; and the Council had already been assured by the Institution of Gas Engineers of their co-operation in this matter. He (Mr. Clare) believed this conference would do a great deal of good, especially to the Heating and Lighting Sections. The Heating Section had expressed approval of such a conference, and had decided to co-operate to the best of their ability. He hoped the Lighting Section would do the same.

The PRESIDENT then delivered the following address on

SCIENCE AND PRACTICE.

The words "Science" and "Practice" are somewhat loosely used; and it is difficult to attach a definite meaning to either. The dictionary does not help us much, and literature perhaps helps us less. The dictionary states: "Science is literally knowledge, but more usually denotes a systematic and orderly arrangement of knowledge." "Practice, the actual performance, or the application of knowledge or science to the wants of men." From this, it would appear that science or knowledge must precede practice. Sir William Hamilton has long ago stated the distinction more clearly—using, however, the word theory instead of science. "There is a distinction, but no opposition, between theory and practice. Each, to a certain extent, supposes the other; theory is dependent on practice, practice must have preceded theory." This appears to me the more natural relationship. Practice generally exists first without explanation, and science is in the first instance an attempt to explain practice by theories. In modern times this attempt to explain is partly experimental; and experiments lead to the discovery of new facts, which themselves both aid explanation and require explanation.

The function of science lies in the explanation of existing facts, and in the prediction and discovery of new facts. In ultimate or fundamental explanations, science has signally failed. No single complete explanation is to be found in the whole realm of modern science. Even the simplest of fundamental concepts have to be accepted without real understanding. In proximate explanation, however, she has been very successful. Vast numbers of apparently dissimilar phenomena have been shown to be similar and capable of classification in comparatively few groups. Practice, then, concerns itself with the doings of things, and science with the explanation of things which have been done.

Sir Alexander Kennedy has well stated the task of the practical man in his Presidential Address of last year to the Institution of Civil Engineers:—

> "Engineering problems differ from ordinary academically 'scientific' problems, partly in that they are much more complex, and consequently more difficult of anything like exact solution, and still more because—exact or inexact—some solution to them has always got to be found. Not only must the solution be found, but it has to be translated into steel and gun-metal, as well as into £ *s. d.*, and any mistake will entail very much more serious consequences than a controversial paper in the 'Philosophical Magazine,' or a letter in 'Nature' pointing out a wrong estimate of terrestrial radio-activity in prehistoric epochs."

Dr. Francis Elgar, in the James Forrest Lecture of this year, deals with the same subject. He states:

> "There are but few problems in the design of ships, as in most other branches of engineering, that can be exactly or completely solved in the full scientific meaning of the word, and those are of a secondary character. The primary or fundamental problems of safety, strength, speed, and steadiness at sea are far too complicated to bring under anything like general mathematical treatment. The results obtained by the most advanced calculations cannot be applied directly to the real conditions of a ship at sea. After all is said and done, they merely relate to hypothetical cases which are simple in character and happen to be amenable to mathematical treatment. Some of these calculations are very elaborate; and their elaboration may tend to magnify their importance. The real problem is often very imperfectly dealt with after they are made; and it can only be solved approximately for working purposes by accepting the results of calculation for what they are worth—judging of the allowances required for their incompleteness, and using them in a scientific way and a scientific spirit to arrive at safe conclusions. We are obliged to come to a definite conclusion somehow, because we have to build ships as well as we can, whether we can solve exactly all the problems that arise in their design or not; and we have to take the responsibility of guaranteeing results, however difficult they may be to obtain."

I agree with both gentlemen. The task of the engineer is to do things, whether he understands them fully or not. If he waits to understand all the various operations involved, he will never succeed with his process or produce his machine. This is evident upon studying the process of evolution of any invention. The progress of heat-engines furnish clear evidence of this. Take first the steam-engine. Newcomen produced a steam-engine with cylinder and piston in 1705, which was considerably used from that date till about 1770. In the Eighteenth Century the science of thermodynamics had still to be discovered. The erroneous material theory of the nature of heat generally prevailed, although Rumford and Davy, about 1799, proved experimentally that whatever heat might be it was not material. Newcomen's engine suggested to James Watt that better things might be done. Before James Watt's success, however, one, Dugald Clerk, experimented with a Newcomen engine and produced continual rotative motion by means of a fly-wheel. This he applied in the year 1767 for driving sugar-mills in Jamaica.

Watt experimented at the Glasgow University with an old Newcomen model, and produced the condensing steam-engine with the separate condenser. He was aided in his work by his knowledge of researches on the latent heat of steam made by Joseph Black, Professor of Chemistry in the University of Glasgow, 1756-60. Watt, however, made many experiments for himself on the pressure and temperature of steam, and he considered that he had established that the quantity of heat required to convert a given mass of water at zero into saturated vapour was the same, whatever the pressure of the vapour might be. This supposed property was known as Watt's law; but it was afterwards shown to be wrong. Errors in theories, however, did not prevent Watt from improving the performance and construction of the steam-engine; so that between the date of his first successful trial at Boulton and Watt's works, Soho, Birmingham—that is, in 1774 and 1819, the year of his death—Watt saw steam-engines of his type applied to numerous purposes in mines and factories on land; while he also saw the beginning of the steam locomotive (George Stephenson, 1815) and the marine steam-engine (Fulton, 1807).

All this great practical success was attained before thermodynamics existed as a science, as Carnot, who published his great work in 1824, may be considered as its originator in one of its most essential requisites—that is, in the idea of a standard engine of maximum efficiency, so widely known at present as a perfect ideal engine of the Carnot cycle. Carnot, however, died at an early age in 1832, and his work made little impression. The discovery of the first law of thermodynamics by Mayer, in 1842, and its absolute numerical determination by Joule, in 1843, paved the way for the great work of Thomson and Macquorn Rankine from 1848 to 1856. Thomson (now Lord Kelvin), from the first and second laws of thermodynamics, deduced the absolute scale of temperature, and settled the present known absolute zero; while Rankine applied these laws to engine efficiency calculations.

Hirn, in 1857, showed for the first time, by actual experiments on a steam-engine, that heat disappears in the engine when work is performed. Regnault, in 1860, studied the thermal properties of steam and gases, and supplied us with most of the physical constants used by engineers dealing with motive power till even now, 47 years after. Under the influence of Macquorn Rankine and Thomson, Glasgow engineers began to understand that the science of thermodynamics enunciated truths useful to them; and this resulted in compounding of marine engines by John Elder in 1853 and onward. Compounding was followed in due course by tripling and quadrupling—later by present-day experiments on superheating.

Science has thus acted on practice; and practice, in turn, acts on science. New forms of heat-engine—for example, the steam-turbine and the gas-engine—have given rise to further investigation on the scientific or abstract side; and to-day a host of investigators are at work on further studying the properties of steam, and investigating the properties of air and flame. So that practical application and scientific investigation go hand in hand, each aiding the other. Even now, however, after more than two hundred years of steam-engine practice, we do not fully understand all the phenomena of the steam-engine. Still less do we fully understand those of the gas, petrol, and oil engine, although active experiment in such engines has now gone on for over one hundred years; and it is forty-seven years since the first fairly commercial engine appeared in Paris. The practice of the gas-engine includes among its most noted foreign names Lenoir and Otto and Daimler; and its science, Beau de Rochas, Slaby, and Witz. Of home names there are many; but I need not go over them. They are well known to you all.

The story of the gas-engine shows the same imperfect knowledge, but shows also practical success attained notwithstanding

ignorance. In 1876, for instance, Dr. Otto thought his success due to the use of stratification in his engine, while in actual fact stratification had nothing whatever to do with it. His success was wholly due to correct mechanical detail, and the effective use of compressed gaseous mixtures. Following Macquorn Rankine, Witz, your President, and others have calculated the effect of compression, assuming simplified cases. Such calculations were made originally in 1882, and have proved a sound practical guide during twenty-five years. By following the compression idea, carefully adjusting all the mechanical arrangements to take necessary strains, gas-engine designers have succeeded in raising thermal efficiencies from 16 per cent. to 35 or even 36 per cent. Twenty-five years' practice, however, has shown that our understanding of the problem is still very imperfect; and we are only beginning to recognize that in large gas-engines fundamental ideas require reconsideration.

In small engines, the main problem is to diminish heat loss, and increase thermal efficiency, by the use of higher and higher compressions and properly proportioned combustion spaces. In large engines, it is becoming increasingly evident that heat loss can pretty well take care of itself. The heat losses from the gases diminish rapidly, as the dimensions of the vessel in which the flame gases are enclosed increase. On the other hand, the flow of heat per unit area also increases to some extent, and the thickness of the cast-iron parts required to transmit the heat increases with increased dimensions and increased pressures. In steam-boiler work, it has long been recognized that furnace flues must be limited in thickness. In large gas-engine practice, we are just recognizing the necessity for limiting the thickness between the hot gases and the water forming the cooling jacket. It may be necessary, in order to accomplish this, to reduce both compressions and flame temperatures. This, of course, involves a reconsideration of the gas-engine cycle, and substitution of other methods of getting economy than that followed by increasing compression. Obviously many things remain to be discovered, and many new inventions require to be made in the immediate future, in order to render such engines applicable to all the purposes to which steam in its various forms can at present be adapted.

I mention these matters to show that the practical man has many serious problems to face—that he cannot always wait to understand every part of his field before finding a solution, and that, consequently, the solution found by him often includes a multiplier intended to neutralize the effect of ignorance. Again appealing to the gas-engine, such engines, compared with an air cycle going through exactly the same temperature processes, usually give efficiencies of from 0·6 to 0·7 of that calculated from the air cycle. This multiplier (0·6 or 0·7), I have been in the habit of thinking, in my own mind, as not so much a factor of safety as a factor of ignorance. It includes the ignorance of certain properties; but it includes them safely, and it even measures them.

Further investigation diminishes the ratio between the actual and the ideal, and recent investigations have changed this factor from 0·7 to something like 0·85. An engineer need not be ashamed to own ignorance; but he must know exactly where his ignorance lies, and, broadly, the proportion to be allowed to cover that. The late distinguished engineer, Sir Benjamin Baker, for example, I understand, felt many doubts as to the calculations of compression strains in the long struts which formed part of the Forth Bridge. But he estimated the extent of his ignorance, and provided for it successfully; so that the Forth Bridge stands to-day. The American engineers who designed the Quebec Bridge were more particular to design it in a form in which, according to their estimates, the stresses could be more accurately determined; but, unfortunately, they do not appear to have estimated the particular part to which this proportion of ignorance applied. Hence they failed; and their bridge fell.

In many other matters we have to be content with a partial solution of problems; and study of different mechanisms which have been produced show faults to be remedied. Where those faults bear upon the health and life of a whole community, engineers should take a very serious view of their responsibilities. In the matter, for example, of the enormous extension of the use of motor cars and motor 'buses, with petrol engines, it is necessary to recognize the fact that, under certain conditions, these engines discharge as much as 10 per cent. of the poisonous gas, carbonic oxide, into the street. It is the engineer's duty to study these conditions, and to so arrange his mechanism as to make life in our large towns healthy and safe.

This question of carbonic oxide arises in matters more closely interesting members of the Society of British Gas Industries. It is the ambition of all gas men, if I may so call them, to find as many uses for coal gas as possible; and they have been enormously successful, both as to light and motive power. If gas consumption is to greatly increase in gas-fires and gas-stoves, it appears to me desirable that you should study the problem much more closely than has yet been done. A great mistake is made by many gas engineers—and, I may say, journalists. They treat the consumption of gas in closed spaces as if the matters to be considered were merely those of consumption of oxygen, and its replacement by carbonic acid gas. I agree that, so far as the production of carbonic acid is concerned, there is no great harm in open gas-stoves or in closed gas-fires. The conditions of combustion of gas, however, are such that, unfortunately, carbonic oxide is readily produced; and this it cannot be too clearly recognized is a really poisonous gas. So far as present open gas-heaters are concerned, this problem does not appear to be satisfactorily solved. Undoubtedly very many of them produce carbonic oxide. The test of this is unfailing, even apart from purely chemical methods of examination. The human being is a delicate reagent to carbonic oxide. I know it myself, because I am long familiar with the effects of carbonic oxide poisoning. Many people have severe headaches with even a minute trace of carbonic oxide in the atmosphere, and many gas-stoves introduce a quite sufficient trace for this purpose.

I am, as I have already said in another place, entirely against the heating of rooms by the products of combustion of either gas or coal admitted to the room itself. It is easy to heat in this way, it is true; and the heating efficiency, so far as heat is concerned, is great. But it is not easy to heat without producing carbonic oxide in some proportion or other; and this should entirely banish such gas-stoves, unless some of you can come forward with a solution of the problem of so burning gas as to produce no carbonic oxide whatever. Even then, however, it is not advisable to heat by sending the products into the room. It is far preferable to burn as little gas as possible in a room. This is easily attained, so far as lighting is concerned, by the Welsbach light; but so far it has not been very perfectly attained by any gas-stove. Even gas-stoves furnished with flues to take away the products of combustion often discharge quite a large quantity of products into the room. This should be remedied. It appears to me that in designing gas-stoves, some fundamental principles have been neglected. It is a well-known fact that if a gas-flame, or practically any flame, comes in contact with a cold surface, or even with a solid surface at all, the combustion becomes imperfect, and carbonic oxide is produced. If the gas could be burned in some way so that combustion was fairly complete before the mass of the products struck any solid body, a great improvement would be effected. And practically no carbonic oxide would be produced. Such a stove may be difficult to design; but, in my view, it is well worth designing.

When the members of the Society of British Gas Industries have greatly improved their fires and stoves, I look forward to an enormous extension in the use of such fires and stoves; and, accordingly, a great extension of the use of coal gas, and the purification of the atmosphere. Without such improvement, however, it would not purify the atmosphere to replace visible smoke by invisible carbonic oxide. I am now speaking from the scientific side; and it may very well be that the practical problem presented is a difficult one to solve. It is for you to solve it.

I have said enough to show how, in my view, practice precedes science and suggests problems for solution by science; while even the partial scientific solution of a problem suggests new fields of practice; and so one reacts upon the other until it is difficult to say which is the more important. There is a difference, however; but notwithstanding the difference, practical men of to-day should be thoroughly acquainted with the results of science, if not in other fields, at least in their own.

Examination of the history of the rise of any industry shows at first a certain thing done which is useful to mankind; and the understanding of the thing done, at first very imperfect, as the years go past increases more and more. This is very clearly shown in the gas industry. At first, a floating knowledge that coal, when heated in a tobacco pipe, discharges gas through the stem, which can be lit; and then the application of this elementary fact by an able man like Murdoch to the lighting of Boulton and Watt's works. Then years of practical application, and considerable commercial and practical success; while yet the complicated chemistry of destructive distillation was unknown. The products of the gas-works, however, gave scientific men subjects for study. Taking one instance only, the discovery of benzol, and from benzol the discovery by Faraday of nitro-benzol, has led to enormously important industrial and scientific results. In the same way, the study of the phenomena of flame luminosity originated by gas lighting, passed through many stages, until a combination of chemistry and practical application was made by Welsbach of all the accumulated knowledge, both practical and scientific.

Numerous scientific discoveries have been made as the result of the gas industry, and numerous practical applications have been made as the result of scientific discoveries. The whole of our gas industry has advanced science, and been advanced by scientific investigation. Not one article manufactured by the members of this Society, or one process for which the members supply apparatus, but has been the subject of long-continued work by many minds—both scientific and practical. This union of science and practice is becoming more and more firm. In older times, professors of our universities were accustomed to deplore the ignorance of the manufacturers in scientific matters, and the manufacturer was accustomed to smile at the ignorance by the professor of the practical problems which had to be faced. A truer appreciation of both departments of work has been attained; and this was very visible in the British Association address of Professor Sylvanus Thompson this year. That address showed a complete appreciation by a scientific man of the work done by the practical man; and I think I can say now that the practical man, on his part, appreciates entirely the work of the scientific man.

In a matter more nearly concerning ourselves, this Society of practical men has had great pleasure in co-operating with the other branch, the professional side of the gas industry; and as a

first result of this co-operation, a great success was attained at the recent Manchester Gas Exhibition. In my view, the co-operation of the Institution of Gas Engineers with our own Society is one which closely resembles the co-operation between Science and Practice. Each is entirely necessary for the other.

At the close of the address,

The PRESIDENT said it was an unusual course for a President to submit his address for discussion; but he should be happy to answer any question that any gentleman cared to put to him, and to reply to any comment.

Discussion.

Mr. T. G. MARSH (Manchester) said in regard to the President's remarks in connection with gas-fires, he was entirely at one with him. He believed a number of stoves that had already been put into use had simply damaged the gas-heating business to an incalculable extent. He was speaking to a friend only the previous day who had been to the Manchester Exhibition. He saw the stoves exhibited there, and then went down to Blackpool, and stayed at an hotel. In his private sitting-room, he had a gas-fire which was simply an abomination. Though it was an open fire, the gases came into the room and the bunsens were most imperfect. He (Mr. Marsh) thought it would be well if the members of the Society would point out how very essential it was, for the good of the industry, that the gas authorities of various towns should have a periodical inspection of gas-fires on the premises of their consumers. Until such a course was taken with incandescent lighting, it was nothing but a source of trouble and annoyance to, and a cause of complaint of, the gas consumers. Until some such inspection was made of gas-fires, he was satisfied that there would be trouble and complaint about the points Mr. Dugald Clerk had raised. He had been exceedingly pleased with the address, and particularly so with the paragraph in which the President called attention to the fact that manufacturers and users of motor cars (and he might have added of all machines) owed a great responsibility and duty to the community. Machinery of any kind when introduced should not become a nuisance to neighbours. Bramwell long ago pointed, in a paper read before the Institution of Civil Engineers, to the wasteful manner in which fuel was used in steam-engines; and down to the present time, there had been men both practical and scientific who had pointed out what was required. Siemens, too, had said that the system of burning fuel was simply barbarous; and he (Mr. Marsh) thought it was nothing other than barbarous. Those who burnt fuel should do so with as little nuisance as possible to others. He was a believer in gaseous fuel for many purposes. Only the previous week, he was speaking to the engineer of a large chemical works; and he said he had got some remarkable figures resulting from the putting of gas-engines into his Company's works. In addition, they now used nothing but gaseous fuel for their various heating processes. He said that they had taken large works in the North of England, and had they known what a success gas-engines were going to be, they would never have taken these new works. Their coal bill, he also stated, had been cut down by one-half; and the Company had this year saved £14,000 by the introduction of gas-engines and gaseous heating. He (Mr. Marsh) believed that all through the line of the uses of fuel and heat, there would be the same economy; and by the co-operation of the scientific man, fuel would be used without nuisance.

Mr. S. Y. SHOUBRIDGE (Lower Sydenham) said he had great pleasure in making a few remarks on the President's interesting address, and more especially in view of the fact that he had the gratification a great many years ago of being associated with Mr. Dugald Clerk in some experiments on the gas-engine in the days of his early researches at Birmingham. He was sure that all present agreed with the President very heartily that it was most desirable Science should be more closely identified with practice than in the past; and it was a happy augury that they found Science represented by a gentleman so distinguished as was Mr. Dugald Clerk in a Society constituted of practical gentlemen, as were the members of the Association. It was a fortunate thing that the Institution of Gas Engineers had now taken steps, by helping forward the Professorship of Fuel at Leeds University, to make the connection between the gas industry and the scientific men of the Universities more possible and more complete. Regarding gas-fires, to which the President had referred, it was an astonishing thing that so many years had passed by, and so many stoves had been made, without the elementary principles of combustion apparently having been properly studied. He thought it was only during the last year or two that gas-fires had had any appliances for regulating the proportions of gas and air, and obtaining proper combustion. But he thought the fires that were now being made were all fitted with these appliances; and this showed that much more attention had been paid to the necessities of the case, and that in a few years they would have in general use fires free from the objections the President had pointed out, which had no doubt injured their introduction very largely.

Mr. H. J. YATES (Birmingham) said that, with reference to the question of the products of combustion from gas-fires, the President had remarked—

> Even gas-stoves furnished with flues to take away the products of combustion often discharge quite a large quantity of products into the room. This should be remedied. It appears to me that in designing gas-stoves, some fundamental principles have been neglected. It is a well-known fact that if a gas-flame, or practically any flame, comes in contact with a cold surface, or even with a solid surface at all, the combustion becomes imperfect, and carbonic oxide is produced. If the gas could be burned in some way so that combustion was fairly complete before the mass of the products struck any solid body, a great improvement would be effected. And practically no carbonic oxide would be produced. Such a stove may be difficult to design; but, in my view, it is well worth designing.

There were a large number of stoves constructed now and used in large rooms where it was difficult to get any means of carrying away the products of combustion, but in which stoves the flames did not impinge in any way on the stove itself; and with a properly regulated atmospheric burner, combustion was fairly good. Mr. Marsh had mentioned that, in a room in which a friend of his was at an hotel, there was a bad fire, and fumes were given off into the room. Well, the stove makers were faced with the difficulty that gas-fires were often fixed where the flue had practically no draught at all. The chimney perhaps smoked, and a coal-fire would not burn there; and the remedy was thought to be the fixing of a gas-fire. In such a case, the gas-fire should not have the blame cast upon it. In the last few years, there had been a great deal of improvement made in gas-fires. The makers, however, all used a common fuel; and he believed it was to the fuel they would have to pay more attention. In the burners themselves, they had achieved a state of efficiency.

Mr. S. GLOVER (St. Helens) said he thought they ought not to accept, without a little more clearly understanding the position, the President's somewhat serious charges against gas-stoves in general. The President would quite appreciate their difficulty in approaching this subject, seeing they had no knowledge of the instrument upon the behaviour of which he seemed to be judging gas-stoves generally. It would be helpful to the discussion if they had some knowledge of the sort of gas-fire from which the President was judging the position, because even from what had been said that evening, it was manifest there were gas-fires and gas-fires. He thought it was hardly true that most gas-stoves delivered large proportions of the products of combustion into the rooms in which they were used, nor did he think that, knowing the proportion of carbonic oxide which imperfect combustion in an internal combustion engine delivered into the atmosphere, they should assume that large proportions of carbonic oxide were delivered into the air of rooms from gas-fires. It was true, as the President said, that the conditions of combustion of gas were such that unfortunately carbonic oxide was readily produced. But then "readily produced" did not, to his mind, always suggest actually produced; there must be certain conditions which led to production. They must take very little guidance from such badly fitted gas-fires as Mr. Marsh's friend found in an hotel in Blackpool, because it was quite evident to him (Mr. Glover), from his own experience, that what was found there might not be caused by the construction of a gas-fire itself, but by a neglected gas-fire. He quite agreed that gas engineers who sent out gas-fires to be used in the consumers' houses should not leave them to get into a neglected state; and he also agreed that gas-fires should be frequently examined. In his practice at St. Helens, he had appointed inspectors whose business it was to see that cooking-ovens were properly used, and that the combustion of gas-fires was as perfect as possible. He thought the word "fuel" used by Mr. Yates should be perfectly understood. He supposed Mr. Yates meant the radiating substance that gas-fire makers called fuel. Gas-fires had in the past been made which lent possibilities to the production of carbonic oxide. But they were being left behind now; and gas-fire makers were bringing a great deal more success into their practice. When the President was speaking of science and practice, he had wondered very much indeed upon which side he was claiming Science, and upon which side he was claiming practice, because he seemed to be separating them like the sheep from the goats. He (Mr. Glover) had hoped and believed that, in the departments of manufacture and distribution, both science and practice were being more completely wedded together than before. He thought this was so with stove makers too; and that now the substances they put into the path of the flames of their burners were not all equally big producers of carbonic oxide. He was old-fashioned enough to have a gas-fire made by the late Mr. Thomas Fletcher, nearly twenty years ago; and he had stuck to it for the twenty years. Placed in the path of the flame (which was a very good flame, and produced very small percentages of carbonic oxide) were tree-like formations of cast iron, which got very quickly raised to the temperature of the flame itself; and he held that the percentage of carbonic oxide which would be produced under such conditions as these would be small indeed. To his knowledge the stove, and many thousands like it, did take all the products of combustion away from the room, and did not under ordinary circumstances deliver any into the room. He knew, too, that manufacturers were now making their gas-fires with such proportioned outlets for the products of combustion that very little would go into the room. It would be better if this was recognized as an effect of the time. He believed the old-fashioned large basket-fires did lend themselves to the flame going wandering about the radiating material, and got lowered in temperature, which was a great fault in gas-fires, and did conduce to the production of carbonic oxide, and possibly its emission into the room. Gas-fire makers were not, however, to be charged with indiscriminately turning out gas-fires built on anything but scientific principles, nor were gas engineers to be charged with the careless sending out of stoves which distributed into the rooms of their

customers products of combustion containing large percentages of carbonic oxide.

Mr. H. M. Thornton (London) said that the discussion would almost make one imagine that gas-stoves were the only things in which the members of the Society were interested. He took it the remarks of the President regarding gas-stoves were more an illustration of what he desired should take place in connection with science and practice—that was the wedding of the two more closely together. In reading through the address, he (Mr. Thornton) gathered that was what the President was trying to achieve. He believed manufacturers, whether engaged in the making of gas fires or meters or in constructional work, were having scientific men attached to their staffs, whose duty it was to advise them on points arising on the scientific side of the business. But unfortunately science was sometimes found impracticable; in many cases things were introduced from the scientific point of view that were, from the commercial point of view, impossible. In his opinion, the last portion of the paper was perhaps the most important. Their Society, which had grown up to one of some importance, and which in his opinion would be of greater importance still, was undoubtedly a means to the end the President had in view in the gas industry—that was, the bringing of the practical and the commercial side of the industry into closer touch with the scientific portion. He ventured to remark, when he spoke at the Dublin meeting of the Institution of Gas Engineers, that he trusted in future there would be a greater and nearer co-operation between the manufacturing and commercial part of the industry and the professional part. The President's address would undoubtedly help towards that end.

Mr. J. Ferguson Bell (Derby) spoke of his appreciation of the address, and mentioned that he believed, in a large number of industries now, there were scientific men on the works staffs; and they were continually carrying out experiments, the useful results of which were incorporated in practice. Speaking as a gas engineer, there was no doubt that during the last few years there had been a great improvement in gas-fires and all kinds of gas-consuming appliances. If it had not been for the advent of the incandescent burner, he was afraid they, as lighting engineers, would have taken a secondary place by this time. Incandescent burners had been improved, and were still being improved, by means of scientific application. He ventured to say the reason gas-fires had not been largely introduced was because there was not at the present time such an economical gas-fire as they could wish. Gas had been greatly reduced in price. It was for the manufacturers to be in a position to put into the hands of the gas engineers such a gas-fire as they could place out and recommend to their consumers, and one that they could recommend as economical. He was very much struck with the portion of the President's address in which he drew attention to the fact that the flame which came into contact with cold surfaces immediately produced carbonic oxide; and there was no doubt that what they had to aim at was perfect combustion before they brought the flame into contact with solid fuel. Improvements had lately been brought forward in the regulation of the air and gas supply of fires; and this was a great step in advance. He could not conclude without congratulating the President on the immense advances he had made with reference to gas as a motive power. His researches had, indeed, greatly facilitated the work of the gas-engine manufacturer.

The President, in replying to the discussion, said he was conscious that many of those present were applying science to the practice of their profession. He had always, among scientific men, upheld the character of the British manufacturers. It had been said that they were not scientific; that the Germans beat them in science, and the French in art and invention. He (the President) had held that the British manufacturer on the scientific side had been most brilliant; and this little essay of his was intended to some extent to show that a man must not wait till he understood everything before he did anything. He did not wish to be misunderstood about the application of science to the production of the gas-stove. He was thoroughly aware there were many excellent gas-stoves; but he had been somewhat unfortunate personally. In a long course of experiments with the gas-engine from 1877-8, he spent his life between the drawing office and the test room for about eleven years. He was at first careless about the exhaust gases in the room, and suffered severely from carbonic oxide poisoning. If one got a good dose of carbonic oxide, it made one very sensitive indeed; and he could now detect carbonic oxide before anyone else, even before the cuprous chloride test. He could not now go into a room for any length of time where there was a gas-fire without feeling it. He had stoves in his house; and for some years he had one in his bedroom. But he found that the products were sometimes so noxious that he was bound to give it up. He had looked at the stove question recently, and was glad to see great improvements. He had a feeling that many of these open stoves were sent out, and that the makers were not studying their interests in sending them out at all. So far as his information carried him, $\frac{1}{8}$ per cent. of carbonic oxide in the air of the room in which they were assembled would kill them all in two hours. This did not mean anything like a large evolution; but even if they had only a moderate evolution, they would be in considerable danger, if there were no ventilation. He was glad to find so many of the gentlemen present were able to inform him that much improvement had been made in the gas-stove; and he was pleased indeed to find they were fully alive to the problem. He had no doubt the problem could be solved. Siemens had pointed out that they must not bring a flame against a solid of lower temperature if they wanted complete combustion. There were other conditions, too; but he had no doubt at all that gas-stove makers had a good appreciation of these conditions. In gas-engine work, they learned very much of what could be done with a flame, and what could not be done, to get perfect combustion. He had experimented a good deal to find the minimum amount of carbonic oxide that could be discharged with the exhaust. It was about $\frac{1}{10}$ per cent. It was supposed to be good practice discharging 2 per cent. of carbonic oxide; it was bad practice to discharge 10 per cent. He believed in gaseous fuel; and he quite shared Mr. Marsh's enthusiasm for it. He thought the method of heating by solid fuel a barbarous one. Perhaps he had been rather strong in the paper; but he wanted to cause a little wakening up to the fact that there were these dangers. If there were a few stoves out giving bad results, the many were blamed. If a gas-fire was put in a proper fireplace, with a proper draught, and there was proper combustion, such a stove should be excellent, and everyone should be able to use such a thing. Though there had been much improvement made, there was a good deal of improvement still to be made. Some makers had not come up to the best practice. This was the case in any industry. What he had tried to do was to apply a little gentle, though not unkindly, pressure to those makers who did not come up to the best practice. He did not think one could ever solve the problem in an open gas-stove by preventing all contact of the flame with metallic surfaces, or burning in a chamber. Perhaps the most innocuous method of using gas was to burn it with a luminous flame in a chamber where plenty of air could get at it. He thought there would be a gain by going in for a ventilated stove. He was glad, indeed, to hear that so many scientific men were employed on works staffs. There was a large output now of young scientific men training in the various colleges; and it was a good thing they should have employment.

Moved by Mr. T. Clapham, and seconded by Mr. J. Mackay, a hearty vote of thanks was passed to the President for his address. Mr. Mackay mentioned that when Mr. Dugald Clerk became President, there were thirty firms in the Society; now there were over sixty.

The President-Elect.

The President read a letter from the President-Elect (Sir George Livesey) regretting his inability to be present on this occasion. He also mentioned that Sir George would enter upon his presidential duties at the February meeting.

THE ANNUAL DINNER.

A little later in the evening the annual dinner was held; and it was a brilliant success from all points of view. The President was in the chair; and among the guests were Mr. G. Croydon Marks, M.P., the President of the Institution of Gas Engineers (Mr. W. Doig Gibb), the Vice-Presidents (Mr. Thomas Glover and Mr. James W. Helps), with the Hon. Secretary (Mr. S. Y. Shoubridge), Mr. Frank Vallance, President of the Society of Architects, Mr. H. D. Searles Wood, Chairman of the Royal Sanitary Institute, Commander W. F. Caborne, C.B., Member of the Council of the Smoke Abatement Society. Officially connected with Gas Associations were Mr. Joseph Davis, Mr. R. Bruce Anderson, Mr. C. Meiklejohn, and Mr. T. A. Guyatt. After dinner there were several toasts; and an excellent programme of music under the direction of Mr. Arthur Barlow, A.R.A.M.

The loyal toasts were first honoured.

Honourable Dealings.

Mr. G. C. Marks, M.P., proposed the "Society of British Gas Industries." He referred to the relations of science and practice, and then to the objects of the Society. He noticed there was one clause in the objects that recognized the frailty of human nature; and it was proposed by the Society to take action so as to ensure honourable dealing. There were black sheep in every profession and every business; but he was glad to see the members of the Society had made up their minds that if there should be any black sheep they should be outside the Society. He also noticed that they wanted to get fair methods in connection with contracts; and he hoped this, too, would be secured.

The President, in his reply, expressed the pleasure he felt at seeing the President of the Institution of Gas Engineers and other members present. The Institution and the Society had discussed many things together; and one successful result of co-operation between the gas profession and the Society had been seen in the Manchester Exhibition. He had no doubt that many other successes would follow, to the advancement of the interests they had at heart. In his concluding remarks, he expressed the pleasure he felt that so eminent an Engineer as Sir George Livesey was going to succeed him in the chair.

Mr. Fred. J. West proposed the "Institution of Gas Engineers and Kindred Associations." In the course of his remarks he alluded to the sympathy and co-operation that had been extended to the Society by prominent members of the Institution. The value of the Society had been recognized; and, with the Institution, there had been discussions on matters of interest to the whole industry.

General Contract Conditions.

Mr. Doig Gibb, President of the Institution, was the first to respond. In one part of his interesting speech, he said he was

personally exceedingly sorry that the preliminary discussion as to the drafting of a set of general specification clauses which should be equally fair to contractor and engineer did not bear fruit. He should use his best efforts towards bringing this about, because he could not conceive that, if the members of the Society and of the gas profession were all fair-minded men, and actuated by a common desire to be absolutely just between man and man, and by the great principle which underlay every true movement in this life—to do to others as they would be done by—there was any difficulty in drafting such a set of general clauses as would be fair to both sides of the bargain.

THE FRANCO-BRITISH EXHIBITION.

Mr. J. W. HELPS, in also responding, said he could repeat with all heartiness what he had said before, that he believed great good would result from the co-operation of the Society and the Institution; and he was sure the latter would never be backward in coming to the Society to ask them to help them out of any difficulty. Knowing what he did, he was sure they would not ask in vain. He also felt that, having introduced the subject at Manchester, he might tell those present how far the Committee for the Gas Section of the Franco-British Exhibition had got in the matter of exhibiting there. It would be remembered that he said at Manchester he most thoroughly appreciated the difficulties that contractors and manufacturers were working under in having sometimes to meet these exhibitions at their own expense, and especially when the exhibitions were of such length as this one. He, however, believed the exhibition would afford an excellent opportunity for showing what could be done by gas in various ways. The Committee that had been formed to deal with this matter in connection with the exhibition was a particularly important one. He might say that the Committee consisted of gentlemen from all parts of the country and Ireland. They felt it was their duty to do all they possibly could for gas, to show that it was not dead, and to show what it could do in lighting and heating, and in other industrial purposes. The Committee proposed to take a certain amount of space in the exhibition; and they believed they would have the necessary funds at their disposal. It was proposed to utilize the space to demonstrate the uses of gas in a thoroughly practical and entertaining way. It had been urged that this exhibition was not a proper place to show at. Though some might go to view the Olympic Games, some would stop to look at matters connected with their industry, if only those matters were presented in a really entertaining way. It was proposed to engage the space and to put up houses and workshops, so that the use of gas could be demonstrated. The Committee proposed to do this from the funds placed at their disposal; and it might be possible for the manufacturers to do something in the same way. It was also hoped that such representations might be made to the authorities connected with the exhibition that they would reduce their charges for space, which were somewhat high, so that models of gas engineering plant could be shown. It was intended by the Committee to do what they possibly could to take the burden off the hands of the manufacturers; and, in doing this, they would be benefiting the contractors and manufacturers. Those who had seen the plans of the exhibition would, he thought, have come to the conclusion that it would be a place that would, during the six months that it was to be open, attract people in great numbers. The Committee of the Gas Section were going to do something there; could not the manufacturers also do something? The Committee did not ask them to do this; they simply suggested it was possible.

Mr. JOSEPH DAVIS, President of the Eastern Counties Association, also responded.

Mr. J. W. BROADHEAD proposed "The Visitors," and response was made by Mr. FRANK VALLANCE, Mr. H. D. SEARLES WOOD, and Commander W. F. CABORNE, C.B. The principal theme of the speeches was co-operation between architects and the gas industry.

"The President" was proposed by Mr. CHARLES CLARE; and the reply of Mr. DUGALD CLERK wound up a very enjoyable evening.

THE "HUNTA" GAS-LAMP.

The latest recruit—and a worthy one it is—to the noble army of inverted gas-lamps bearing distinguishing names, is one which has been introduced by Mr. Robert Hunt—who, it may here be mentioned by way of preface, has but recently severed, in order to start business on his own account, a connection with the New Inverted Incandescent Gas-Lamp Company, Limited, which dated from the very commencement of their career. Mr. Hunt is naturally desirous of making a good beginning; and he feels confident that in presenting to gas suppliers and users the attractive looking lamp shown in our illustration the results will be satisfactory both to them and to himself.

For the benefit of those who are unable to visit his Farringdon Street show-rooms and inspect it for themselves, it may be mentioned that the "Hunta" self-intensifying lamp is made in two sizes; the largest of these taking the ordinary inverted mantle, while the other is arranged for a special mantle of convenient size between the No. 1 and the Bijou. The first-named, it is claimed, gives a light of 115-candle power, with a gas consumption of 4 cubic feet per hour; and the smaller size, a light of 80-candle power with a gas consumption of 3 cubic feet per hour. The lamps are fitted with a gas regulator and opal crown. The primary object of the latter is, of course, to prevent discoloration of the fitting; but it will be noticed that it also contributes in no small degree to the pleasing appearance of the lamp. The method of fixing the opaline globe and the inner clear glass cylinder is simple and convenient—allowing them both to be removed together. The globe is held by three screws in a metal ring; and when the inner cylinder is slipped into it, the bead of the cylinder rests upon the rim of the metal ring, which fits into a bayonet catch on the top part of the burner. Thus by slightly turning the globe, the bottom portion of it can be immediately detached without interfering with the mantle in any way. The lamps are finished in polished brass or steel bronzed; and they can also be had fitted with a bye-pass, lever, and chain.

"Hunta" Self-Intensifying Gas-Lamp.

From the foregoing remarks, it must not be inferred that Mr. Hunt has no other "strings to his bow" than the pattern of lamp here illustrated. In addition to having been appointed London Agent for the well-known "Etna" inverted gas-burner of Messrs. Alfred Arculus and Co., of Birmingham, he is introducing the "Hunta" inverted burner. This latter—which can be had either with or without a gas regulator—is fitted with a china deflector, and takes the standard size inverted globe. It is finished in polished brass or steel bronzed; and it is said that, with a gas consumption of only 3 cubic feet per hour, the lamp furnishes an intense white light of 70-candle power.

In concluding this brief notice, we would express the hope that Mr. Hunt, as the newest comer, may share the success that has fallen to those who have preceded him in developing a branch of lighting that has proved such an inestimable boon alike to those who make gas and those who use it. "Good business" in the incandescent gas-fitting trade, spells "prosperity" to gas suppliers.

Products of the Dry Distillation of Peat.—A recent number of "Engineering" contained an illustrated description of the works at Beuerberg, in Upper Bavaria, for the utilization of peat by the Ziegler system. In the course of the article, a diagram was given showing the residual products obtained by the process; and we take from it the following figures, which are percentages: Coke, 35; tar, 4; tar water, 40; gas, 21. From the tar are obtained: Gas oil, creosote oil, and paraffin; while from the tar water are produced sulphate of ammonia, methyl alcohol, and acetate of lime.

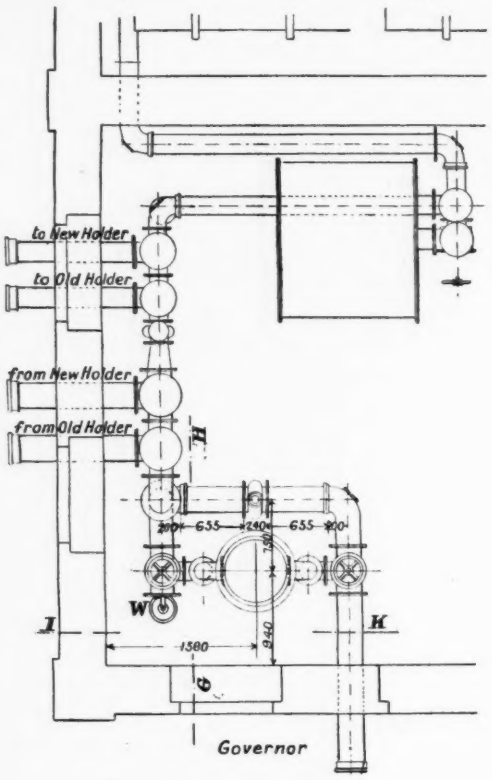
The Local Government Board and Reinforced Concrete.—Our readers may remember that towards the close of the lecture delivered at the recent meeting of the Midland Association of Gas Managers by Mr. M. Kahn, on "Reinforced Concrete as Applied to Gas-Works," he referred to the attitude of the Local Government Board in regard to the use of this material for constructional work in this country. He drew attention to the fact that the Board will only allow fifteen years for the repayment of loans for municipal works in which this class of construction is used, compared with thirty years for buildings in brick and stone. The matter is referred to in an editorial note in a recent Engineering Supplement to "The Times." The writer pointed out that, as reinforced concrete is extensively used by Government departments, municipal authorities, harbour and water boards, and home and foreign railways, the matter is of considerable importance. He considers that probably the best move for those affected and interested would be to furnish convincing data of notable works carried out in connection with railways and harbours, and also to give colonial examples of reinforced concrete work that have been more than fifteen years in existence. When this is done, it is thought the Board will reconsider the matter, and probably remove the cause for present complaints of those interested in this new and important branch of constructional engineering, which has made such strides in other countries.

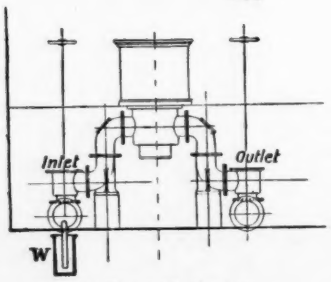
TWO COAL-GAS ACCIDENTS IN GERMANY.

A recent issue of the "Journal für Gasbeleuchtung" contains an article by Dr. Leybold, of Hamburg, describing two accidents which occurred in a couple of the smaller gas-works of Germany during the past year, followed by loss of life through suffocation or explosion. As these accidents appear to show serious faults in the design of the works, and lend themselves to the pointing of useful lessons, Dr. Leybold discusses the two episodes minutely.

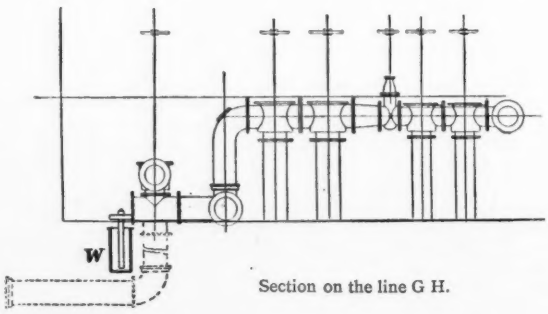
In the first case a stoker going to his work before daylight found the retort-house empty, but heard a noise showing that the works' holder was falling rapidly. He entered the so-called meter-room; noticed a powerful odour of gas; and found a man lying on the floor unconscious. He called the manager who opened all doors and windows. As soon as it was possible to enter the room and daylight had broken, three men were found to be dead—one on the floor of the room as already mentioned, and two in the pipe-chamber underneath. As shown by fig. 1, the so-called meter room contained numerous pieces of apparatus; the gas entering at one end from the purifiers, passing through the meter, entering a distributing main having the inlets to, and the outlets from, the two holders, then passing to the governor, and finally proceeding to the town supply. The room also contained the exhauster and its engine. Before the governor, an open condensing pot, about 16 inches deep, was placed in the pipe cellar. This pot, marked W on fig. 1, and shown again in the two vertical sections, was merely covered with a wooden top; and after the accident it was found to be practically empty. One particular man was supposed to examine it periodically, and should have inspected it a few days before the accident. Inspection, however, was very difficult, as the floor-boards of the room had to be removed, and the man had to creep down into the passage in an inconvenient position. Moreover the pot had to be emptied by means of a dipper when it was too full.

In discussing the accident, Dr. Leybold remarks that a condensing pot should not be placed in such an inconvenient situation as to encourage the proper attendant to neglect it. If placed in a pit within a house, it should be a closed vessel emptied with the aid of a pump; and, when exposed to the full holder pressure, the seal in the pot should be at least 20 inches deep. Moreover it would seem that a condensing pot in the position referred to should be practically unnecessary if, as in the case under consideration, the inlets and outlets to the meters were provided with closed condensing chambers in the yard of the works. The accident also teaches that every portion of the plant which needs periodical inspection should be quite readily accessible; all underground passages containing pipes, &c., should have ladders leading to them; and ventilation should be provided there. The works where the accident occurred had no smoke helmet, and





Section on the line I K.



Section on the line G H.

Fig. 1.

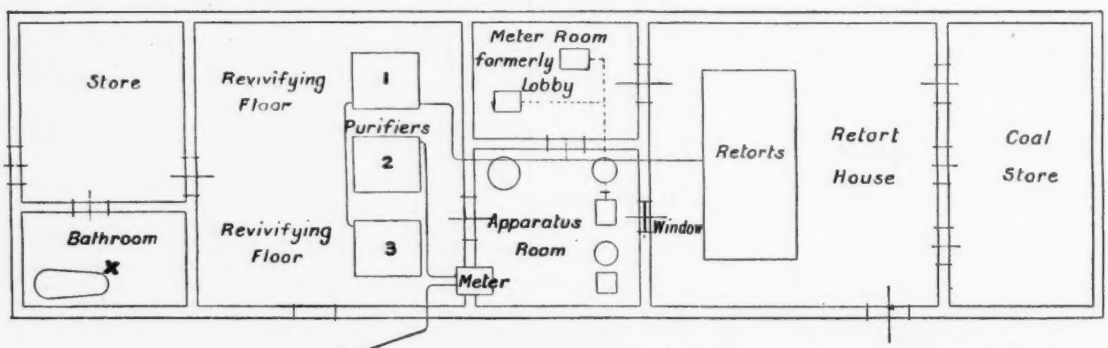
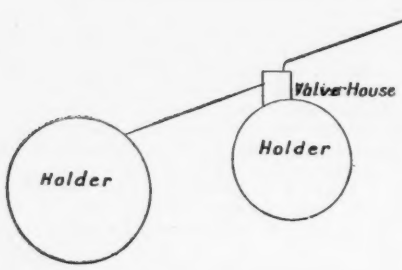


Fig. 2.



the safety lamp was kept in the office, whence it could not be procured during the night.

In the second accident, two men were seriously injured by fire. The gas-works were originally designed in a satisfactory manner; but in order to increase the capacity, various alterations had been made. As shown by fig. 2, the whole plant was contained in a single rectangular building having the coal store on the right and the retort-house next to it. On the left of the latter, a door led into a room originally intended as a lobby for the stokers, but afterwards used to contain a gas-engine, with flame ignition, which was employed to drive the exhausters. A door also led from this room to the room containing the meter and other apparatus—a window (but no door)

being between the apparatus room and the retort-house. On the left of these two rooms was the purifying-house, entered from the open air; and again on the left was a store room, entered from the purifying room, and leading to a small room in the corner of the building containing a bath for the men. On one particular night, the gas blew the seal of the middle purifier. One of the men at once opened the two doors leading from the purifying room through the store room into the bath room, so as to procure some water to throw into the seal. A naked light was burning near the bath; and directly the man opened the second door, a serious explosion took place at the spot marked with a X on the plan. This destroyed the store room and the purifying room, and finally set fire to the roof of the apparatus house and the retort-house. On examining the works, it was found that in two situations—viz., between the room containing the motor and that containing the meter, &c., and also between the purifying room and the bath room—there were doors joining buildings containing naked lights with others wherein gas might very probably escape (a system of construction which is wholly inadmissible). It was also discovered that the louvre ventilators in the roof of the purifying house had been covered up with filter cloths from a sugar factory; so that no facilities were left for any gas escaping from the purifiers to pass away. The reason for the gas blowing the seal of the purifier cover was either that the bell of the holder had become fixed by the formation of ice in the tank or that the purifier-seal had not been kept properly full of water.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

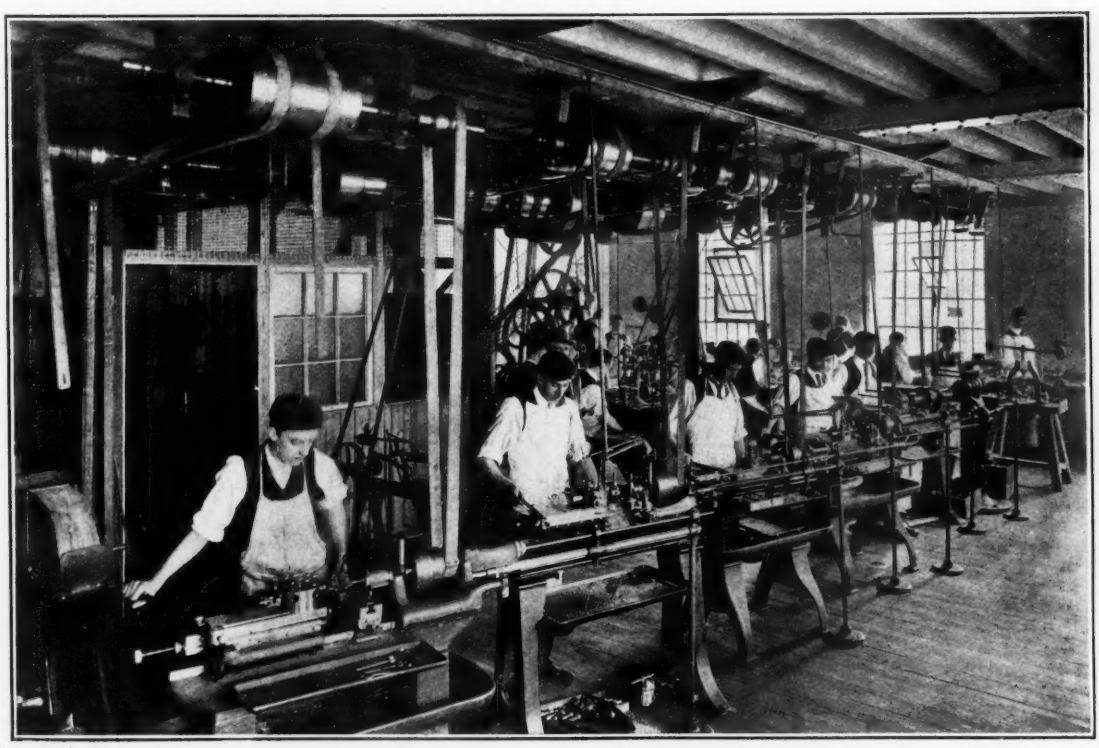
Visit to Messrs. George Glover and Co.'s Works.

In spite of the fact that it was a "mid-week visit," somewhere about seventy members of the London and Southern District Junior Gas Association accepted the invitation of Messrs. George Glover and Co., Limited, to inspect their works at Royal Avenue, Chelsea, last Wednesday afternoon, when they were able to see everything in full operation.

On arrival, they were welcomed by Mr. J. William Glover, the Managing-Director. He pointed out that the firm were specialists in dry meters; they were making nothing else at their Chelsea works. He then, with the aid of a black-board, fully explained the mechanism of both the ordinary and prepayment meters made by them, and drew the attention of the visitors to some interesting exhibits which had just come back from the Dublin Exhibition. There was a glass case containing the many parts of a 3-light prepayment meter; and also a 150-light meter which was passing and registering correctly as small an amount of gas as 6 cubic feet an hour. Mr. H. M. Thornton, Managing-Director of the Richmond Gas Stove and Meter Company, also made a few remarks, in the course of which he said it seemed to him that the Southern Junior Association were more active than those in some other parts of the country; and he admired the way they went about, not begrudging themselves any trouble, but endeavouring to see all they could and learn all they could. He heard that this was not the first visit they had paid to a meter works; and he was glad of it. The ideal perhaps would be to have one meter for the whole country; but he (Mr. Thornton) thought it was never intended in any business that they should have only one company selling one article. They all enjoyed fair competition, because it kept them up-to-date and encouraged improvement. Then there was another point about these visits. He did like to feel that they in the manufacturing part of the gas business were getting into closer touch with those engaged on the other side. It seemed to him that the closer they could get together, the better would be the result to both; and he sincerely trusted that the Technical Press would encourage these visits to the works of manufacturers, with a view to bringing about closer co-operation than in the past. He remembered that at Dublin, where the Gas Institution met this year, he had an opportunity (thanks to the President) of making a few remarks in connection with gas-fires; and one of the points he mentioned was that he thought it desirable there should be closer co-operation between the manufacturers and the gas suppliers generally. He believed there was a desire on the part of the heads of the profession to see this come about more and more. He welcomed the members again, and trusted the visit would lead to pleasant recollections, and that they would increase in many ways their stock of information on the subject of gas-meters and everything connected with them.

The party was then split up into batches, and conducted through the various departments by Messrs. J. W. Glover, Albert Glover, Staples, Lyon, and Wicks, all of whom pointed out and fully explained the various objects of interest in the works. There are really nine shops, which occupy three floors at the back, and two in front of the premises; the addition of the three floors at the back some three years ago having more than doubled the size of the works. The departments inspected comprised the repairing and hand-made meter shop (in connection with which it may be remarked that all meters over 10-light are hand made), the stamping shop for the parts of the smaller meters, the leather shop, the automatic meter shop, the brass shop for ordinary meters, the case making and finishing shop, the painting shop, the foundry, and the testing shop. The meters are put under a pressure of 10 inches, to ascertain whether they are gas-tight, before being sent to the last-named shop to be tested for accuracy at varying pressures from $\frac{1}{2}$ inch to 3 inches. All the machinery is driven by two 20-horse power gas-engines. An interesting feature in connection with the soldering of the meter cases by means of gas instead of charcoal was an installation of tinmen's stoves connected by a series of pipes with a small fan blower; the air and gas being controlled separately, and meeting at the stove.

At the conclusion of the inspection (in the absence of the President), Mr. W. J. Liberty proposed a very hearty vote of thanks to Messrs. Glover and Co. for so kindly receiving the Association, and to them and the staff for putting themselves to the inconvenience of showing the members round the shops while work was in full swing. When examining all the clever mechanism, he wondered—as no doubt others had done—how people managed



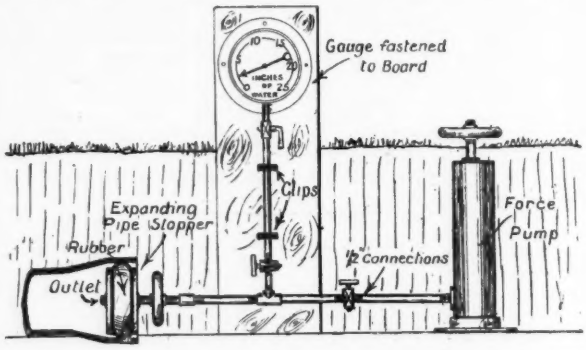
The Automatic Meter Shop at Messrs. George Glover and Co.'s Chelsea Factory.

to get on before there were gas-meters. The very words "gas rental department" pointed back to the time when they paid so much per burner for gas. He had with him documents showing how the gas was charged for in two instances about the year 1820, when gas was 10s. per 1000 cubic feet. The Wandsworth Gas-light and Coke Works charged for a No. 1 argand burner from dusk until 9 p.m. £2 10s.; until 10 p.m., £2 16s.; until 11 p.m., £3 4s.; and all night, £4 8s. a year. One jet with a 4-inch flame for hall or passage, was 30s. If gas was burnt on Sundays, the charge was one-sixth extra. At Bodmin, there was a scale commencing with a single jet from dusk until 9 o'clock, £1 a year; and it was stated that one hour extra would be allowed on Saturday nights. There was also the same stipulation as to one-sixth extra charge being made in the event of the gas being used on Sundays. There were various other conditions; and altogether at that time, the state of things was very unsatisfactory for the gas industry. Just then, however, Mr. Clegg, of the Chartered Company, came into the field, and invented in 1820 his "self-acting gauge," which "measured and registered in the absence of the observer the quantity of gas delivered by any pipe that was connected with the gas-light main." The machine occupied a space about 2 feet by 1 foot. This was really the first gas-meter; and it resulted in justice being done to both the consumer and the seller. Mr. W. A. Barnett, in seconding the resolution, pointed out that besides making his gauge or meter register gas, a few years later Clegg proposed to employ the same instrument for purifying gas, by driving it backwards through a little milk of lime. He was afraid this would not be considered a very satisfactory method now. He was sure they were all much interested in what they had seen. The state of the meter at the present day was something to marvel at. Mr. E. E. Grimwood supported the motion, which was carried by acclamation.

Mr. J. W. Glover in acknowledging the vote, said Mr. Liberty had taken them back a long way. The first meter, of course, was a wet meter, and then there were various attempts at the dry meter; but the meter they had seen that day was really the survival of the fittest. If at any future time individual members cared to repeat their visit to the works, he would be glad to see them, and, if they would give notice of their coming, he would endeavour to meet them personally; but in his absence his son, Mr. Albert Glover, would always be equally pleased to welcome them. Mr. Thornton also returned thanks, and said he was desirous that the Association should, as soon as the new works of the Richmond Company were ready at Warrington, go down and see what they were doing in the stove department. If they would go, he would do his best to make their visit an interesting one.

TESTING THE SOUNDNESS OF GAS-MAINS.

In the "JOURNAL" for the 12th inst. (p. 488), there appeared a description, from a recent issue of "De Ingenieur," of a simple and portable apparatus for testing the soundness of gas-mains, which has recently been employed with success at 'sGravenhage. Mr. Samuel Carpenter, the Engineer and Manager of the Dorking Gas-Works, writes that, as the illustration which accompanied the notice reminded him of an old friend, he sends on a sketch of a similar and inexpensive apparatus which was fitted up and used for testing during the laying of a steel main in his district last spring. No explanation of the arrangement is needed, as the sketch, which is here reproduced, speaks for itself.



Production of Monazite and Zircon in 1906.

Deposits of monazite (the source of the rare metal thorium, which is used in the manufacture of incandescent gas mantles) have lately been found in North Carolina, South Carolina, and Georgia, and in several States of the Far West. In North and South Carolina, the production in 1906 was 847,275 lbs., valued at $152,560, as against 1,352,418 lbs., valued at $163,908 in 1905—the figures for both years including a small quantity of zircon. The area in which minable deposits of monazite have been found is growing yearly, especially southwestward, in which direction it now reaches to the Georgia line. Zircon has been obtained in quantity as a bye-product from monazite concentrates. An experimental concentrating plant of the United States Geological Survey at Chapel Hill, N. C., is now making tests as to the best method of separating zircon and other products of commercial value from monazite concentrates. The output of zircon last year all came from Henderson County, N. C.

New Method of Jointing Gas and Water Mains.

A paper on this subject was recently sent by M. Gilbert to the Société des Ingénieurs Civils of France, and is summarized in the monthly publication of their transactions. The author first draws attention to the extent and importance of losses by leakage, and the large capital sum that such losses justify in effecting repairs. In addition to this are the cost involved by gas accidents and the danger to the public. The passing of heavy mechanically driven vehicles along the roads, and escaping electrical currents, are fruitful sources of serious leakage. Ordinary lead joints cannot long resist the effects and movements of the soil (for the lead is compressed against the smooth part of the spigot end of the pipe); while rubber jointing is still less effective through not preserving its elasticity. The tight and durable method of jointing proposed by M. Gilbert combines the elasticity of rubber with the strength and inoxidability of lead. First, a rubber ring tightly compressed is placed in the joint at the moment of laying a pipe. Then a line of lead is run into two opposing grooves in the socket and spigot, which thus forms a key, offering the maximum resistance to longitudinal movements of the pipes. Flexibility in other directions is insured by the elasticity of the rubber band. The strength of the keyed lead joint can be easily increased wherever there is reason to anticipate greater stresses and strains than usual. Such pipes are easily and quickly laid, and have been adopted at various places in France both for gas and water.

The "English Mechanic" gives the following recipe for a compound good for cleaning paint on engines: To 1 gallon of water add ¼ lb. of borax and ½ pint of lard oil. Rub this upon the paint to be cleaned, then wipe off with clean waste or soft cloth. The wiping off must be done before the mixture has time to dry.

In the list of Mayors elected on the 9th inst., we notice again the name of Alderman Edwin Finn, the Chairman of the Lydd Gas Company, who has established a record by being elected for the twentieth time. Another of the new Mayors connected with gas supply is Mr. Enoch Ellis, the Chairman of the Gas Committee of the Doncaster Corporation; while Mr. C. A. Tresise, the Vice-Chairman of the Gas and Electricity Committee of the Burton-on-Trent Corporation, has succeeded the Chairman of the Committee, Alderman T. E. Lowe, who has just completed his second year of office as Mayor.

The drilling of bolt-holes in partially green concrete is a tedious process, says the "Engineer," quoting from a contemporary, owing largely to the frequent wedging of the drill. One contractor seems to have hit upon a simple method of drilling these holes without undergoing the delay incident to wedging. He uses a compressed air drill hung in the guides of a small pile-driver frame, the drill occupying the same position as would the hammer in pile-driving. The drill is suspended by a wire rope, and raised or lowered by means of a hand windlass. One advantage of this arrangement is that a longer drill can be used than with the ordinary tripod outfit. A small metal pipe is carried with the drill into the hole, and through this water is forced under heavy pressure, carrying off the chips, and thus preventing all tendency to wedge. Many such holes have been bored in partially green concrete to a depth of upwards of 6 feet.

The current number of the "Quarterly Review" includes an article, by Mr. Urquhart A. Forbes, on the water supply of the United Kingdom. The importance of treating water supply on broad lines was pointed out by the Royal Commission of 1869, when the adoption of the watershed area as the administrative unit for water supply was recommended. Since the water supply for purposes of navigation is derived from the various watersheds traversed by canals and river navigations, it is considered desirable that the authority in each watershed should be empowered to exercise some control over canal companies and river trustees with respect to the amount of water to be abstracted from it. Such watershed boards with the powers indicated would, it is thought, be able to carry out the scientific regulation of all water from its first arrival as rain to its disappearance in the ocean. It has been suggested that the staff of the central authority, which would be a department under the Local Government Board, would, in addition to the administrative head, comprise (1) an engineer and assistants, with some special knowledge of geology and water supply, charged with the duty of collecting and digesting for use all the facts requisite for the scientific treatment of our water system; (2) a bacteriologist and a chemist, with a special knowledge of the bacteriology and chemistry of sewage, trade effluents, and water supply, who should be provided with a laboratory for experiments; (3) a staff of inspectors for carrying out its supervisory work with respect to both pollution and waste of water.

REGISTER OF PATENTS.

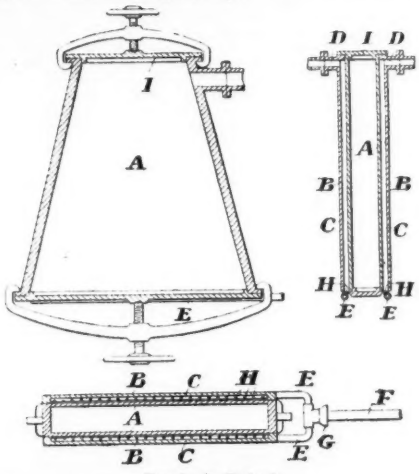
Destructive Distillation of Coal.

BOWING, J., of Wandsworth, S.W.

No. 24,687; Nov. 3, 1906.

In the heating of gas-retorts as now generally employed, the patentee points out, a large percentage of fuel relatively with the quantity of coal carbonized has to be used. In patent No. 580 of 1905 [see "JOURNAL," Vol. XCIII., p. 292], there is described a method of transmitting heat to the retort by the use of superheated steam; and this method had the effect of very considerably reducing the quantity of fuel necessary for the distillation of a given quantity of coal. As the results of numerous experiments, however, he has discovered that a still further considerable reduction of fuel can be effected by the use of gas as the heating agent—making use of a retort the surface of which is, as far as possible, enclosed in a jacket; and in this jacket one or more slits or apertures are formed, beneath which are placed atmospheric gas-burners in such a manner that when the gas is lighted the jacket space will be filled with flame of a practically uniform temperature at all points.

To enable his invention to be understood, he describes it in connection with a retort of the type referred to in the former patent—that is to say, a retort wherein the material to be treated is in a layer of uniform thickness, and which is made of conical shape, and provided with a removable top and bottom to allow of the filling of the retort and the discharging of its contents respectively.



Bowing's Retort.

The illustration shows a longitudinal vertical section of such a retort, a transverse section of certain parts, and a horizontal section.

The walls of the retort proper A are arranged vertically and tapered upwardly, in one direction; B are the outer walls enclosing the jacket spaces; and C the spaces open at the bottom and at the upper end provided with apertures D through which the products of combustion can escape. E are atmospheric gas-burners connected with a common gas-supply pipe F provided with an air-mixing chamber G. Each of the burners is provided with a series of nozzles or nipples H at which the gas burns; the nipples being placed in such close proximity to each other that when the gas is ignited the flames unite so as to prevent the formation of any passages between the flames through which air could pass.

With this arrangement it will, it is said, be found that when the walls with which the flame comes into contact are heated to a certain degree the whole of the jacket space will be filled with lambent flame of a practically uniform temperature at all points.

In practice, it has been found advantageous when distilling coal to use a retort of a width between the walls of from 5 to 6 inches, and to make the jacket of a width of 1 inch. The retort illustrated is supposed to have a height of 6 feet and to contain 3 cwt. of coal.

The outer surface of the jacket can be covered with a non-conducting material to prevent, as far as possible, the radiation of heat; and the width of the jacket space will be determined by the size of the heating flames employed and according to the heat required.

I is the cover to the retort normally secured by a stirrup; while the bottom of the retort (removed when the contents are to be withdrawn) is also normally secured by a stirrup.

Vertical Retorts and Settings Therefor.

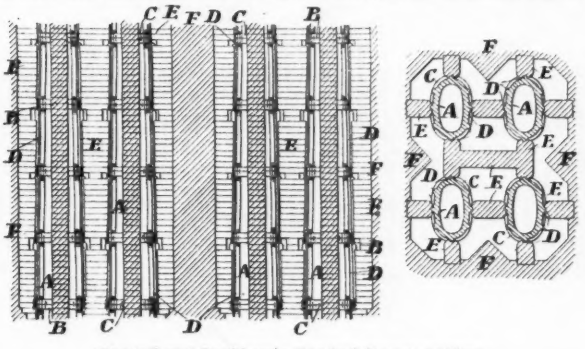
WOODALL, H. W., of Wimborne, and DUCKHAM, A. Mc.D., of Upper Parkstone, Dorset.

No. 24,695; Nov. 3, 1906.

In their patent specification No. 11,956 of 1905, the inventors described a vertical retort for the carbonization of coal having longitudinal ribs projecting from its outer surface and of such depth that they abut against the setting or against corresponding ribs of adjacent retorts. According to their present invention, the retort sections, or some of them, are made with a flange at each end and with shallow ribs extending from one flange to the other. In order to set a retort made up of such sections, suitable brickwork columns are built in the setting in such a manner that they engage with the ribs on the retort sections.

The illustration shows a part vertical section through a retort setting constructed according to the invention, and a part horizontal cross section.

The retort sections A are made with top and bottom flanges B C, and with ribs D. These sections are set in brickwork columns E—some extending from the sides of the setting F and others built between the retorts. The bricks on the side of each column which is adjacent to the retort have rounded corners, and are grooved to receive one of



Woodall and Duckham's Vertical Retort Setting.

the ribs on the retort. In this manner, the retorts are held securely, and the area of the retort protected from the heat by the supporting column is reduced to a minimum.

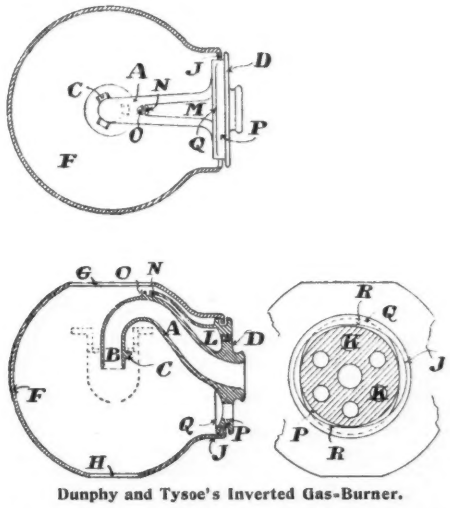
In order that the flues may be suitably contracted in cross section, the sides of the setting are shaped to surround each retort as far as possible.

Inverted Incandescent Gas-Burners.

DUNPHY, A. L., and TYSOE, J., of East Greenwich.

No. 20; Jan. 1, 1907.

The object of this invention is to construct a burner with suitably shaped nozzle, bye-pass, and fittings with attachments so arranged as to protect the adjustable gas and air inlets and other metal fittings from the destructive action of the heat and products of the burnt gas, and to allow the use of a globe, shade, or spherical chimney with a side aperture and inside flange, "so shaped as to be capable of secure attachment to the burner without the intervention of metal screws or other metal work."



Dunphy and Tysoe's Inverted Gas-Burner.

The illustration shows a plan of the burner and bye-pass, with the spherical chimney in section with an aperture at the bottom; a vertical section through the centre of the burner, bye-pass, and chimney, showing apertures top and bottom; and a vertical section through the back flange of the burner showing the oval shapes of the aperture in the chimney neck and inner face of the back flange.

The tube A (of fire-clay or other refractory material) has a nozzle B prepared with lugs C to receive the mantle; a back flange D grooved and prepared to receive the metal gas and air inlets E; and a glass chimney F, of spherical shape, with apertures in the top G, bottom H, and neck J in its side for fixing to the back flange D. The tube A is made with a bend in it, so that its nozzle B shall hang vertically, while the back flange D lies with its axis horizontal or radially at an angle above or below. In either position it has its periphery prepared to receive the neck J of the chimney F.

The back flange D has in it a number of perforations K, the top one of which may be utilized for the connection to the inner chamber L provided for the bye-pass M, with its nozzle N, and shield O, all shown lying on, and forming part of, the tube A; while any one of the remaining perforations may be used for the connection of an ordinary bye-pass tube.

For connecting the back flange D with the neck J of the chimney F, a circular groove P is made around the back flange D, and the peripheries Q of the inner face of the back flange D, and R of the neck J of the chimney F, are of a slightly elliptical form; R having its major axis shorter, and minor axis longer than Q. Thus, when the neck J of the chimney F, on being placed in position in the groove P with the ellipses Q and R coinciding, is turned in the groove P to bring the ellipses at right angles with each other, they will be securely locked when the apertures G and H in the chimney F are vertically one above the other.

Gas Washer and Cooler.

DOHERTY, H. L., of New York.

No. 12,751; June 1, 1907.

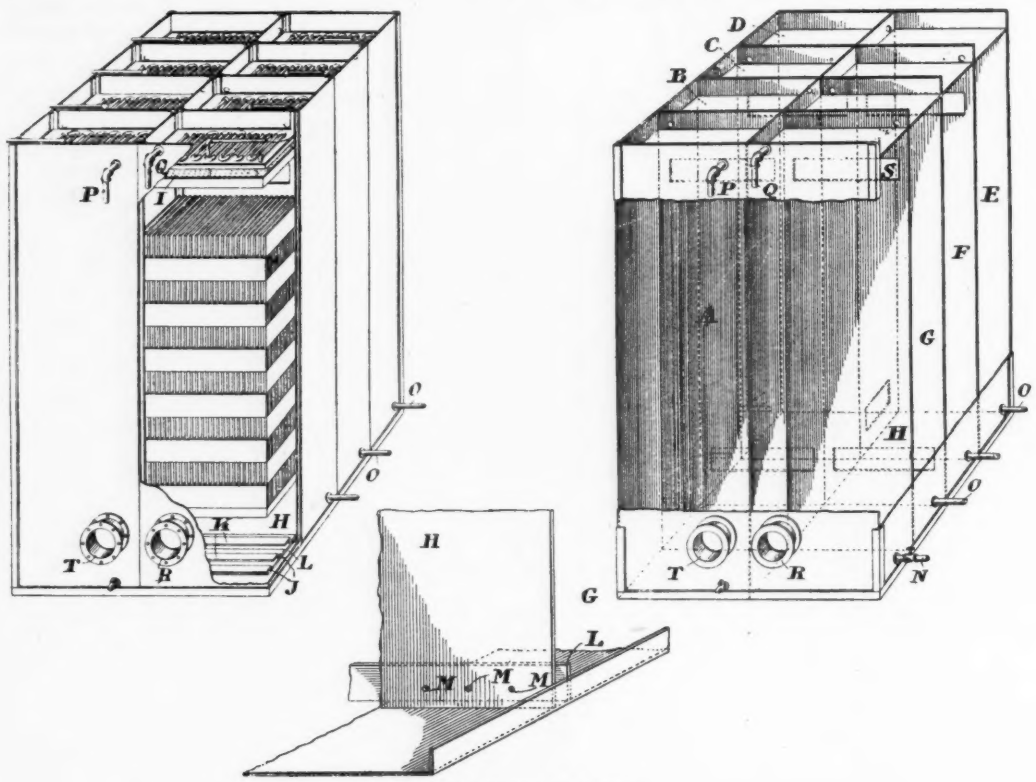
This apparatus for washing and cooling gas has for its object to provide that it "shall perform its functions rapidly and effectively, with minimum loss of the enriching constituents of the gas by condensation."

The outer casing of the apparatus may be of any convenient form, though preferably rectangular in plan. In the illustration the casing is shown divided into a number of chambers by longitudinal or transverse partitions, or both. There are eight chambers shown—A, B, C, D, &c., formed by a longitudinal wall or partition and transverse partitions. Each chamber contains a mass of material of any suitable character, having numerous interstices or passages, so as to cause any liquid discharged thereon to be spread over a larger surface in flowing down through the mass. The inventor prefers, however, to employ a number of layers or tiers of flat plates arranged as follows: A short distance above the bottom is a shelf formed by angle-irons with inwardly-projecting flanges (not shown) extending around the inside of the chamber or across opposite sides of it. Resting on their edges on the flanges of these angle-irons is a series of plates of wood, iron, earthenware, or other suitable material. On the plates, extending at right angles thereto, as shown, and also, standing on edge, is another series of plates; and above the latter is a third series, parallel with the first. This arrangement of alternating longitudinal and transverse plates is continued until the chamber is nearly full—thus providing a large number of passages, so that liquid delivered on top of the pile will, in descending to the bottom of the chamber, be divided into numerous streams spread over a large total area, and thus be brought into contact with all parts of a stream of gas passing through the chamber.

Near the top the chambers are hermetically closed by horizontal partitions providing an upper compartment above each chamber. In the compartments are cooling pipes, coiled so as to provide a maximum length of pipe in each. In the apparatus illustrated, the pipes are in parallel lengths connected in pairs by bends as shown; and the liquid, entering at the middle, flows backwards and forwards across the compartment toward the sides of it. At diagonally opposite corners the pipes pass through the horizontal partitions and discharge upon perforated trays I, by which the liquid is delivered evenly upon the edgewise plates, which, as before stated, constitute means for dividing the liquid into numerous streams and distributing it over a large area.

In the bottom of each chamber is arranged a series of baffle-plates, as shown in chamber H, consisting of three horizontal plates J, spaced apart, and two horizontal plates K above the spaces between those below. The liquid falling from the distributor strikes the baffle-plates and flows gently off the latter to the bottom of the chamber, thereby avoiding any violent agitation of the liquid collected therein.

The liquid in the bottom of the chamber G can flow into the chamber H by an arrangement as follows: L is a dam spaced slightly from the vertical partition, which latter is pierced by one or more apertures M. The liquid rising in the chamber G will finally flow over the dam and rise in the space between the latter and the wall until it escapes through the openings M. The total area of the latter is preferably such that they are submerged, with the result that they are sealed by the liquid, and so do not allow the gas to pass from one chamber to another. By



Doherty's Washer and Cooler.

similar arrangements chamber A is in communication with B, B with C, C with D, D with E, E with F, and F with G. Hence liquid introduced into A will flow through all the chambers successively, and finally leaves the apparatus through an escape pipe N from the chamber H.

Extending from chambers B, C, D, E, F, G, near the bottom, are pipes O connected with pumps (not shown), which are connected with the cooling pipes above, so that liquid may be pumped from the bottom of each chamber, delivered to the cooling pipe, and again discharged upon the distributor. The excess, over what is re-delivered to the distributor, flows out of the chamber to the one following, escaping finally from the chamber H through the pipe N.

The liquid in the pipes may be cooled by radiation into the air, or the pipes themselves may be immersed in a cooling liquid. For this purpose, the compartment above the chamber A is provided with an inlet P, by which the water may be introduced. From this compartment the water flows into the next through an opening, thence to the next, and so on, and finally out of the last compartment through the outlet Q. The openings are located preferably at diagonally opposite corners of the respective compartments, so as to better distribute the water and give it a longer flow over to the cooling pipes.

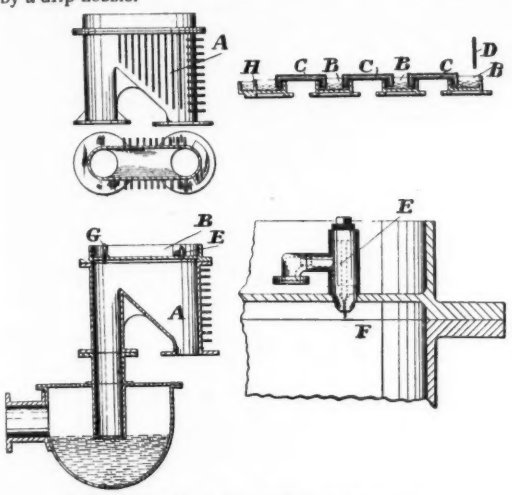
The liquid—such as cold water, ammoniacal liquor, &c.—with which the gas is to be washed and cooled, is delivered through the cooling pipe in the compartment above the chamber A; and being discharged on the perforated tray below the chamber closure, it is delivered evenly upon the distributor, and thence to the bottom of the chamber. Accumulating therein, it flows over the dam, similar to that shown at L, into the chamber B. From the latter it is pumped through the outlet pipe O and delivered to the cooling pipes in the compartment above the chamber. There it is cooled by the water which is introduced into the first compartment, and which is, as previously explained, flowing through the successive compartments. Collecting in the bottom of chamber B, a part of the liquid overflows into C, whence a portion of it is pumped to the cooling pipe in the compartment above, and finally delivered upon the distributor in the chamber. This process is repeated in each of the chambers, except the last, and from that the liquid escapes through the pipe N. At the same time, the gas to be scrubbed and cooled is admitted to the chamber H through the inlet R. Rising in the chamber it passes through the distributor, where it is brought into contact with the scrubbing and cooling liquid over a large surface, and finally escapes into chamber G through the opening S. Flowing downward into the chamber G, it passes through another distributor and receives another washing, and loses still more of its heat. This process is kept up, the gas flowing alternately up and down until, reaching chamber A, it flows out through the pipe T.

It will be evident that the washing and cooling liquid has the highest temperature in the compartment H, where the hot gas enters the apparatus; and that, the gas having lost some of its heat in the chamber just mentioned, the liquid in the chamber G is at a lower temperature. For the same reason the temperature of the liquid in F is still lower, and so on through chambers E, D, C, B, and A, in which latter it is coldest, being delivered thereto fresh. In this way the gas, after the apparatus has been in operation for a few minutes, at no time is subjected to a liquid at a temperature greatly below its own; and it therefore never suffers a sudden and violent fall in temperature. The consequence is that condensation of the volatile hydrocarbons in the gas is reduced to a minimum. Moreover, the gas on entering, containing as it does then the most impurities to be washed out, encounters the hottest liquid to do the scrubbing, and the coolest and cleanest gas comes in contact with the coldest and freshest liquor.

Preventing Stopped Ascension Pipes.

SMITH, A. H., of Lytham, and SHAW, F. G., of Darwen.
No. 2828; Feb. 5, 1907.

This invention relates to apparatus employed in the manufacture of illuminating gas with the object of obviating or minimizing the liability of the ascension pipes to become choked or stopped. It consists of an arch-pipe, preferably provided with a radiator surface, together with a supply of water in the cap or cover of each arch-pipe, maintained at a uniform level by syphon bends from one common source, while the supply to any desired pipe can be immediately disconnected when requisite. The water from the cap or cover is fed into the ascension pipe by a drip-nozzle.



Smith and Shaw's Regulating Ascension Pipe.

In the illustration are to be seen a view in elevation of the arch-pipe and radiators, a sectional plan view of the arch-pipe, a sectional elevation of the arch-pipe and a portion of the hydraulic main, a sectional elevation of the syphon bend arrangement for water supply and circulation, and a view, in elevation, of the drip-nozzle over the ascension pipe.

The arch-pipe has a funnel-shaped portion A directly over the top of the ascension pipe, constituting an expansion chamber, where the temperature of the gas is reduced; the outside of the chamber being preferably provided with radiating ridges or surfaces to induce the cooling process. The cap or cover of each arch-pipe is made in the form of a shallow tank or cistern B, and the adjoining tanks or cisterns are connected by removable syphon bends C, so that any one tank can be immediately disconnected when desired. The tanks B are supplied with water from one common source, such as D; and the supply in each cistern is maintained at one level by the syphon bends C.

Each tank is provided with a drip-nozzle E above the ascension pipe. The plug of the drip-nozzle is provided with a spindle F, which, when the plug is screwed down, goes through the nozzle and removes any obstruction. When the plug is screwed up, the water-way in the nozzle is open. Plugs G are provided to allow of any tank being emptied when desired, and an overflow way, such as H, is also added to one or more of the cisterns or tanks.

APPLICATIONS FOR LETTERS PATENT.

24,897.—CHERRY, W. R., and BUSH, J., "Gas engines and pumps." Nov. 11.
24,913.—HOLMES, P. F., and HOWELL, H., "Ammonia stills." Nov. 11.
25,004.—BLACKBURN, G. N., "Gas-engine." Nov. 12.
25,008.—ROBERTSON, J. R., "Automatic valves for gas lighting." Nov. 12.
25,036.—BOULT, A. J., "Water-gas apparatus." A communication from J. H. Taussig. Nov. 12.
25,104.—SMALL, F. J., "Stoves and grillers." Nov. 12.
25,105.—SMALL, F. J., "Locking tap for mains." Nov. 12.
25,141.—WATSON, R. C., and PORTER, W. F., "Anti-vibrator." Nov. 13.
25,146.—ALLAN, D., "Acetylene generators." Nov. 13.
25,166.—MACKAY, W. M'D., "Treating spent ammonia liquor." Nov. 13.
25,208.—STEINMULLER, L., "Liquid meters." Nov. 13.
25,215.—JAUBERT, G. F., "Manufacture and purification of gas." Nov. 13.
25,223.—TRUDGEN, S. A. & C. G. C., "Shield for gas cooking-stoves." Nov. 14.
25,240.—THE SUNLIGHT AND SAFETY LAMP COMPANY, LTD., and SMITH, T. B., "Inverted burners." Nov. 14.
25,253.—M'DONALD, J. H., and LETHAM, A., "Cocks and taps." Nov. 14.
25,279.—SCULTHORPE, J., "Producing gas." Nov. 14.
25,280.—SCULTHORPE, J., "Gaseous regenerator." Nov. 14.
25,311.—FOUSSET, R., "Treatment of solutions containing ammonia." Nov. 14.
25,322.—SMITH, C. H., "Gas-engines." Nov. 15.

At Worthing, Sussex, a married woman named Eliza Pullen has been convicted of taking money from her own penny-in-the-slot gas-meter, in order to obtain drink. She was fined 30s.; and her husband undertook to repay to the Gas Company the 6s. 5d. owing to them.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Use of Burnt Oxide of Iron.

SIR,—On reading Mr. Tysoe's valuable paper, on the use of burnt spent oxide for the purification of gas, and the report of the discussion thereon, as published in your last issue, I venture to think that the publication of the following extracts from the "JOURNAL" may not prove uninteresting to your readers.

The older members of the profession will, doubtless, remember the costly litigation—extending over many years—between the late Mr. F. C. Hills and the gas companies, in reference to his patent for purifying gas by means of oxide of iron. In the trial at the Guildford Assizes in 1858, the following evidence was given by my father, the late Mr. Alfred King, M.Inst.C.E., as regards the use of fresh oxide and also of burnt spent oxide.

Extract from "JOURNAL OF GAS LIGHTING," *Aug.* 31, 1858 (*p.* 531).

ALFRED KING, *Esq., examined by Mr.* DENMAN.

I am the Engineer of the Liverpool Gaslight Company and also of the Liverpool United Gas Company, and have been so since the year 1826. In the course of that time, I have given considerable attention to the mode of purifying gas. Until April, 1856, I used the lime process. At one of my stations I then commenced the use of oxide of iron, prepared by decomposing the sulphate of iron with lime, producing an oxide of iron and a sulphate of lime. That oxide, by exposure to air, became a hydrated peroxide. When it becomes saturated with sulphuretted hydrogen, it is removed from the purifying vessels and exposed to the air; it thus recovers its power, and is used over and over again. I have used the same material certainly as often as thirty-five times. I have occasionally burnt off the sulphur in an oven heated to redness. I believe the heat renders the oxide anhydrous; but I do not profess to be a chemist. In that condition I have used it over and over again—in one case as many as twenty-two times, and have found it effectual in purifying gas.

Baron BRAMWELL: I thought it was a conceded matter between the parties that if heated to a red heat it would not purify?

Mr. BOVILL: No; not that it would not purify, but that, being heated to a red heat, it would be anhydrous.

Cross-examined by the ATTORNEY-GENERAL.

The preparation of the oxide, by decomposing sulphate of iron with lime, was done under my direction. Several tons were so done. The process was to take the common green copperas and place it in a mill, adding a little water to make a pasty mass; then to put in a quantity of lime and as much more water as was necessary to make it a stiff paste. The mass was then removed and cut to pieces with a spade, and as it dried it became a powder. The sulphate of lime remained part of the mixture, and the combined substance was placed in the purifier, and gas passed through it. I do not profess to give a chemical opinion, but I believe the oxide first produced was hydrated. When removed from the purifying vessel, it was thrown upon a floor and exposed to the action of the atmosphere, which completely renovated it. The application of heat was a subsequent process. The substance became at length so diluted with sulphur that it was, after some twenty purifications, put into an oven furnished with flues, and heated till it became red-hot. It was frequently stirred, so as to expose it more thoroughly to the action of the atmospheric air and heat, and the effect was to burn off the sulphur. The material was then taken from the oven and laid out to cool, and afterwards used again, as when first prepared. This I began to do in 1856, and I have continued to use it till the present time.

By Mr. BOVILL: It answered very well afterwards. I am not prepared to say as well as at first, but it did purify, and after three or four times just as well.

By the JURY: I was not guided by any instructions.

In the year 1863, Mr. Hills applied to the Judicial Committee of the Privy Council for a prolongation of his patent; but, after a long hearing, the petition was dismissed, and he was ordered to pay £1000 towards his opponents' costs.

On that occasion, I gave the following evidence, which is reported in the "JOURNAL" for July 14, 1863, p. 469.

Extract from "JOURNAL OF GAS LIGHTING," *July* 14, 1863 (p. 469).

Mr. WILLIAM KING, *examined by Mr.* DRUCE.

I am Assistant-Engineer of the Liverpool Gas-Works, and have been connected with the Company about eight years. I am practically acquainted with the purification of gas. Our Company, for the last few years, have used native oxide of iron—bog ochre. We have had it principally from Messrs. Dawber and Son, of Hull. We use it alone, just as it is received, and we find that it entirely removes the sulphuretted hydrogen. The price we pay, upon the average, for the bog ochre delivered at the works is 33s. per ton, which is about 1s. per bushel. After it has been used in the purification of gas, it revives perfectly by mere exposure to the atmosphere. We have used it as many as thirty or forty times before it became inert. After it has become thoroughly saturated, we have sold it; we have also made sulphur from it ourselves. The price we have sold it for is 23s. per ton. We obtain the sulphur by mere distillation. The waste material is placed in an ordinary gas-retort, and, as heat is applied, the sulphur is driven over. It is a simple process. No peculiar furnace is required for the purpose. We get about £6 per ton for the sulphur so produced. Mr. Hills

prevented our using the bog ochre by injunction. After that, we entered into an arrangement with him, one of the terms of which was that, in consideration of the large sum paid by us, we should receive an absolute licence to use his or any other material. Since we have had that licence, we have not used his material, but have continued to use the native bog ochre.

Cross-examined by Mr. HINDMARCH.

The ochre is capable of being used again thirty or forty times. We began to use it about the middle of the year 1860. Mr. Hills interfered a few months afterwards; but I do not remember the exact time. We do not burn off the sulphur at all; we get it by distillation in a retort. We have done it at various times during the last few years. The product is a very pure description of sulphur.

By Sir J. COLERIDGE: The sulphur flows off as a liquid. This [producing sample] is a specimen of sulphur which I myself saw flowing from the material.

By Mr. HINDMARCH: The bog ochre comes to us direct from Ireland, and we put it in the purifiers just as we receive it.

By Mr. DRUCE: I should think about 3000 million cubic feet of gas have been purified by us with it.

On this evidence, I may remark that the sulphur was distilled by placing the waste oxide in old iron retorts, which were then still in use in some of the works; and the burnt oxide was afterwards placed in the purifiers.

It will, therefore, be seen that fully 50 years ago, burnt spent oxide was successfully used to a considerable extent in the Liverpool Gas-Works for the purification of gas.

WILLIAM KING,
Late Engineer Liverpool United Gaslight Company,
5, *Beach Lawn, Waterloo, Liverpool, Nov.* 22, 1907.

The Coalite Process.

SIR,—Having been on the Continent, I regret having been unable to reply earlier to your correspondent "M.Inst.C.E."'s letter in the "JOURNAL" for Nov. 12.

"M.Inst.C.E." is good enough to write that he finds my contribution to the discussion of "Coalite" to be of very little value. If I were inclined to be discourteous, I would reply: "Just so; but if my contribution is of very little value, yours, my dear Sir, is of much less." But let that pass.

My letter was never intended to open a technical discussion even on the lines of the "Coalite" prospectus (!). In fact, it has been clear to me how hopeless such a discussion would be in the face of the uncompromising attitude adopted by our Technical Press and by gentlemen of the type of your correspondent "M.Inst.C.E." (whoever he may be) towards the process. I would, however, like to state that my figures were quite tenable and reasonable; and considering they were based on net results, I fail to see where the fine disregard of costs comes in. Even supposing there are many gas-works, as your correspondent contends, content with 10,000 cubic feet per ton, and supposing they did happen to find the half-gallon of benzol per 1000 cubic feet in their gas, of what use would it be except to retain it there towards producing the necessary illuminating power? Surely he does not contend that it could be rendered available as benzol, and the illuminating power maintained all the same?

Your correspondent "M.Inst.C.E." has shown great ingenuity in misconstruing my letter; otherwise he surely would not credit me with the silly idea of suggesting supplanting water gas by "Coalite" gas. What I did point out was the possibility of supplanting the costly oil enrichers by a rich "Coalite" gas if a gas-works desired to produce the same; or, in the event of the "Coalite" people finding no market for illuminating gas, there would remain the profitable alternative of extracting the benzol, and using the gas, denuded of its illuminating constituents, as a power gas, for which it appears it is pre-eminently fitted.

Whether "Coalite" can be produced, as your correspondent "J.D.B." queries, without an extravagant cost of fuel, labour, and maintenance remains to be seen. If, however, it can, we gas men, as "J.D.B." sagely remarks, will have been taught a very profitable lesson.

F. D. MARSHALL.
19, *Queen Anne's Chambers, S.W., Nov.* 23, 1907.

Widnes and Mr. Hanbury Thomas's Comparison.

SIR,—In your issue of the 19th inst., an interesting account is given of the progress of the Sheffield Gas Company, and of the honour that has been so deservedly bestowed upon the Company's notable General Manager, Mr. Hanbury Thomas, in his promotion to the office of Managing-Director.

Mr. Thomas, in the course of some remarks, spoke of the selling prices of gas in ten large provincial towns in England twenty years ago, compared with those of to-day. The figures, which were taken from Parliamentary Returns and from "Field's Analysis," show that, with the exception of Sheffield, where the reduction in price amounted to 10d. per 1000 cubic feet, others had decreased only 1d., 2d., and 3d. per 1000, while in one case there was no change, and in two others an actual advance in price!

Widnes, unfortunately, does not happen to be a large provincial town, nor has it the distinction of having its accounts included in "Field's Analysis." For this and possibly other reasons, Widnes is not included in the comparison—an omission which I trust I may be pardoned for desiring to rectify. Widnes records are to be found in the Parliamentary Returns, and reference to these will show that the selling price of gas has in twenty years fallen from 2s. 4d. to 1s. 3d., or a reduction of 1s. 1d. per 1000 cubic feet, which is a little in advance of Sheffield's excellent record.

ISAAC CARR.
Widnes, Nov. 22, 1907.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1908) RELATING TO GAS AND WATER SUPPLY.

The following are among the notices which have been given for Bills to be promoted next session in connection with the supply of gas and water.

Ammanford Urban District Council Water.—Application will be made by the Ammanford Urban District Council for authority to maintain and continue their existing water-works; construct others, consisting of a compensation reservoir, an overflow conduit, and two pipe-lines; and abstract water from the River Loughor, and supply it in the urban district of Ammanford and the rural district of Llandilsfawr. Provision will be made for entering into agreements with the Rural District Council of this place and other bodies, in regard to the supply of water in bulk outside the limits, and their contributions to the cost of the works. The necessary borrowing powers will be required.

Audenshaw and Saddleworth Urban District Councils.—Application will be made for an alteration in the constitution of the Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Joint Committee, so as to enable the Audenshaw and Saddleworth Urban District Councils, or either of them, to combine with the Committee. The Bill to be promoted will fix the contributions of the Councils to the capital of the Committee; and the Councils are to be credited with excess rates levied by the Committee in their districts. The borrowing powers of the existing combining authorities are to be reduced.

Blackburn Corporation.—Authority will be sought by the Blackburn Corporation to extend their limits of gas supply so as to include the township of Clayton-le-Dale, in the rural district of Blackburn, and to supply gas or power gas, in bulk or otherwise, to local authorities, companies, and persons within or beyond the limits. The Corporation wish to be exempt from penalty for failure to supply gas, and also for insufficiency of pressure, defect of illuminating power, or excess of impurity, in case of unavoidable cause. Power will be required to purchase lands for protecting the water-works and the supply from pollution, as well as to borrow money.

Blaydon and Ryton Water (Transfer).—Application will be made by the Blaydon Urban District Council, the Ryton Urban District Council, the Weardale and Consett Water Company, and the Newcastle and Gateshead Water Company, or some or one of them, for power on the one hand to effect transfers of, and, on the other, to acquire, portions of the Councils' undertakings. The Blaydon Council wish to hand over to the Weardale and Newcastle Companies so much of their undertaking as is situated within the Companies' limits; the Ryton Council desire to sell their water-works to the Newcastle Company; the two Councils wish to sell to the Consett Iron Company, Limited, their respective interests in certain tanks, mains, pipes, and apparatus in the parish of Chopwell, and to the Weardale Company certain other mains, &c., in the same parish. The Bill to be promoted will provide for the determination, as from the date or dates of transfer, of the Councils' obligations with respect to the supply of water, and will confer them upon the two Water Companies. Power will be sought by the Weardale Company to acquire lands and easements, and by the Newcastle Company to construct works, consisting of a service reservoir in the parish of Ryton Woodside and three aqueducts or pipe-lines. The two Companies will seek permission to apply to the purposes specified their existing funds, and any money they still have power to raise.

Bognor Gas.—Application will be made by the Bognor Gaslight and Coke Company, Limited, to be dissolved and re-incorporated. The present capital is to be confirmed and converted, and more will be applied for. Power will be required to maintain and enlarge the existing gas-works, and extend the limits of supply so as to include the town and urban district of Bognor, and the parishes and places of Bersted, Felpham, Pagham, Aldingbourne, Eastergate, Barnham, and Yapton, within the rural district of Westhampnett, in the county of Sussex. It is proposed to ask for the repeal of so much of the Petersfield and Selsey Gas Act of 1901 as relates to the supply of gas to the parish of Pagham. The Bill to be promoted will define the illuminating power of the gas to be supplied, authorize the Company to alter the present charges, and make and enforce regulations in regard to the price of gas supplied by prepayment meters, and also to ensure that money put into them shall not be deemed to have been paid until the Company shall have actually received it. Authority will be asked to supply gas in bulk beyond the limits.

Bromley and Crays Gas.—Authority will be sought for an amalgamation of the Crays and Bromley Gas Companies, and for the transfer of the undertaking and powers of the former Company to the latter, whose name it is proposed to change to the Bromley and Crays Gas Company. Further powers as to the supply of gas will be required by the amalgamated Company. The Bill to be promoted will contain provisions in regard to the officers, &c., of the Crays Company, the re-arrangement of the present capital and the raising of more money, the regulation of the dividends, and the testing of gas. The other powers to be applied for are of the usual character.

Criccieth Water and Improvement.—The Criccieth Urban District Council seek authority to supply water, acquire the undertaking of the Criccieth Water-Works Company, Limited, and construct new works, consisting of two intakes in the parish of Clynnog and a number of pipe-lines. The Bill will contain the usual provisions with regard to water supply; and application will be made for the necessary borrowing powers.

Dartford Gas.—The Dartford Gas Company will apply for power to construct and maintain gas-works, purchase, sell, and let lands, consolidate and convert their capital, and raise more money. It is proposed to make the standard price of gas 4s. per 1000 cubic feet, limit

the dividends, and alter the existing provisions in regard to the quality of the gas and the means of testing it.

Derby Gas.—The Derby Gas Company will apply for an extension of their limits of supply, and for authority to exercise within them their present powers. Sanction will be sought for the acquisition of the undertaking of the Belper Gas and Coke Company, and for the payment of the purchase price in stock. The Belper Company will be wound up. It is proposed to acquire the Milford Gas-Works, owned by Mr. G. H. Strutt, and to pay for them, in whole or in part, by the issue of stock. Power will be asked to manufacture and store gas on lands in Belper and Milford, and enter into agreements with the Corporation of Derby for the construction of a coal-conveyor across Ford Street. Additional capital will be required.

Draycott Gas.—Application will be made by the Draycott Gas Company for the amendment of the Long Eaton Gas Act, 1901, in so far as it relates to the supply of gas by the Long Eaton Gas Company within the limits of supply of the Draycott Company, as defined by their Act of 1888, and for authority for the removal, purchase, acquisition, or transfer to the Company of the mains of the Long Eaton Company within the district defined. They will likewise ask for power to purchase the undertaking of the Castle Donington Gas and Coke Company, and to apply for a Provisional Order to supply electrical energy. It is proposed to consolidate and convert the existing capital and ask for more, as well as for authority to supply gas on special terms in certain cases and to alter the prescribed illuminating power of the gas and the apparatus and burner for testing it.

East Metropolitan Power Gas Supply.—Application will be made by the British Coalite Company, Limited, for authority to construct gas-works at Barking, and supply power gas in East London and North Woolwich. [Their notice is more fully dealt with in another part of the "JOURNAL."]

Garw and Ogmore Gas.—Application is to be made by the Garw and Ogmore Gas Company for confirmation of their site and works at Pontycymmer, and for authority to construct new or additional works on lands to be purchased compulsorily, and manufacture and store gas and residual products. They will also seek power to extend their limits of supply so as to include the whole of the district of the Ogmore and Garw Urban District Council not already within the Company's statutory area, as well as a portion of the district of the Penybont Rural District Council. The Company will ask to be authorized to raise additional capital, amend or repeal section 40 of their Act of 1891 in regard to the illuminating power of their gas, make agreements with local authorities and others for furnishing a supply in bulk, and acquire by agreement the existing public supply of gas at Tondu.

Gosport Gas.—Authority will be sought by the Gosport Gas Company to acquire and hold lands, and purchase, erect, or take on lease, and furnish and equip, dwelling-houses for persons in their employ, and also offices, show-rooms, and other buildings, for the purposes of their undertaking. The present limits of supply are to be defined; and the Company will seek authority to charge a higher price beyond the urban district of Gosport. It is proposed to convert the existing capital, and apply for power to raise more. The Bill to be promoted will contain provisions fixing and regulating the price to be charged for gas supplied through prepayment meters, and the charge to be made for these meters, and the stoves, ranges, and fittings supplied or used in connection therewith. The Company will ask for the repeal or amendment of the provisions of their Acts with respect to the illuminating power and quality of the gas, and for relief from penalty in the event of accidental inadequacy of pressure or deficiency in lighting power or purity. Amendments are also proposed in regard to the supply of gas for public lighting and the charge for meters.

Huddersfield Water.—The Huddersfield Corporation will apply for the amendment or repeal of their Acts with respect to the discharge of compensation water from the Blackmoorfoot and Butterley reservoirs; and the Bill to be promoted will contain provisions for ascertaining the mill occupiers' requirements in this matter.

Lincoln Corporation Water.—The Lincoln Corporation intend to apply for power to construct new water-works, consisting of a well and pumping-station in the parish of Elkesley, in the rural district of East Retford, two aqueducts or pipe-lines (both commencing at the pumping-station, but one ending in the River Poulter and the other in the existing Westgate Street reservoir), and an approach road. It is proposed to ask for an extension of the limits of water supply, and for power to levy and increase the rates and fix the time for their commencement and collection. Authority to raise money will be applied for.

Llanelly Gas.—Authority will be sought by the Llanelly Gas Company to convert and consolidate their existing capital and augment it. It is proposed to repeal section 38 of the Act of 1874, giving the Local Board power to appoint an additional Director, and also section 48, relating to the charge for gas, and introduce a sliding-scale of price and dividend. The provisions of the above-named Act relating to the testing and pressure of gas are to be altered or repealed, and others substituted. Among the other proposals of the Company is the reduction of interest on consumers' deposits.

Manchester Corporation.—The Manchester Corporation will apply for authority to carry out certain works in Longdendale. They will comprise extensions of the existing watercourses at the Woodhead, Vale House, and Bottoms reservoirs, a watercourse at the Torside reservoirs and another at the Rhodes Wood reservoir, an extension of the existing weir of the Etherow Pool, and two diversions of public roads. In the Bill to be promoted, further provision will be made for carrying into effect the transfer to the Corporation of the portion of the gas undertaking of the Stretford Gas Company which is in the township of Chorlton-cum-Hardy (now part of Manchester), and for rendering inapplicable the enactments of the Stretford Gas Company within the township. Additional borrowing powers will be required.

Merthyr Tydfil Corporation.—Authority will be sought by the Merthyr Tydfil Corporation to construct water-works in the counties of Brecknock and Glamorgan, and take water from the Taf Fechan. The works comprise an impounding reservoir on the above-named river, an aqueduct commencing at the reservoir and terminating in the borough of Merthyr Tydfil, and three road diversions. Provisions now in force with regard to compensation water, the size of works, and the existing Pentwyn reservoir are to be repealed or modified. Borrowing powers will be applied for.

Monmouthshire County Council.—Application will be made by the Monmouthshire County Council for authority to construct water-works, together with the necessary reservoir, aqueducts, roads, and other works to convey the water from Brecknockshire into Monmouthshire. They seek power to acquire land compulsorily and by agreement, and to collect and impound the waters of the Grwyne Fawr and its tributaries in the Black Mountains by means of a reservoir in the parish of Llanelieu, near Hay. The Bill will contain provisions for making bye-laws to prevent the pollution of the water, and to extinguish all rights of sheep-washing in any of the waters within the drainage area. The County Council further seek power to supply water to local authorities and to companies or persons already supplying water under parliamentary authority within the Administrative County of Monmouth, and the sale of water in bulk outside the county. Borrowing powers will be required.

Padiham Urban District Council.—The Padiham Urban District Council will seek authority for an extension and definition of their limits of gas and water supply, and for the exclusion of the Accrington District Gas and Water Board from the included townships. New gas-works are proposed, and authority will be applied for to purchase the gas-mains, &c., belonging to the Parish Council of Read and the water-mains of the Rural District Council of Burnley. The Bill will include provisions in regard to the quality and pressure of gas and additional powers relating to the supply of both gas and water, and the rates to be charged. It is intended to ask for an extension of the time granted for the completion of works already sanctioned. Additional borrowing powers will be required.

Pontypridd Water.—Application will be made by the Pontypridd Water Company for authority to construct additional works in the counties of Brecon and Glamorgan. They will comprise five reservoirs, several aqueducts or pipe-lines, a tramroad, and road diversions. It is proposed to ask for an extension of the Company's limits of supply, and for power to alter and increase the rates, rents, and charges under the Act of 1864, to make bye-laws to prevent waste and for certifying fittings, and to raise additional capital.

Rochdale Corporation.—Authority will be sought by the Rochdale Corporation to construct water-works, consisting of a covered service reservoir, two pipe-lines in connection therewith, and a communication road. Application will be made for an extension of the time specified by the Act of 1898 for the completion of the storage reservoir there authorized, and also for power to raise more money.

Skegness Urban District Council.—Application will be made by the Skegness Urban District Council for sanction for the transfer to them of the undertaking of the Skegness Water Company, and for authority to supply water within limits to be defined in the Bill. Provision will be made for maintaining the existing works, preventing the pollution and waste of water, and raising the money required for the purchase.

Southwell District Gas Company.—Application will be made by the Southwell District Gas Company, Limited, to be dissolved and re-incorporated with change of name. It is proposed to extend the works, and supply gas in various parishes in the county of Nottingham. The Bill will contain the usual provisions in regard to gas; and authority will be sought to apply for a Provisional Order to enable the Company to supply electrical energy. Additional capital will be required.

South-West Suburban Water.—The South-West Suburban Water Company are desirous of consolidating and converting their existing capital and raising more, and they will apply for the necessary authority for doing this, as well as for making agreements with local authorities and others for the supply of water in bulk.

Swansea Valley Gas.—Authority will be sought for the incorporation of a Company for the supply of gas within certain parishes and places in the counties of Glamorgan and Brecknock. The undertaking described in the Ystalyfera Gas Order, 1905, is to be vested in the new Company, as well as private gas-works at Pontardawe; and sanction will be asked for the acquisition by agreement of the supply of gas to the district now served from the private works of Messrs. Player at Clydach. The Bill will contain the usual gas provisions, define the Company's limits, and specify the capital required.

Swinton and Mexbrough Gas.—The Swinton and Mexbrough Gas Company wish to be dissolved and re-incorporated. It is proposed to regulate and increase the capital, limit the profits, and create reserve, insurance, and renewal funds. The area of supply is to be the township of Swinton and the parishes of Mexbrough and Adwick-upon-Dearne, in the West Riding of York.

Tenterden Gas.—The Corporation of Tenterden intend to apply for authority to purchase the undertaking of the Tenterden and District Gas Company, Limited, and for additional powers relating to gas supply. On the transfer being effected, the Company will be wound up and dissolved. Sanction will be required to the raising of the necessary money.

Wath-upon-Dearne Gas.—The Wath-upon-Dearne Urban District Council will seek confirmation of an agreement they have entered into for the purchase of the undertaking of the Wath-upon-Dearne and District Gas Company, Limited, and will ask for authority to supply gas in the Company's district. They want power to maintain, extend, and construct gas-works, supply and deal in gas meters, stoves, fittings, &c., levy rates and charges, and raise the necessary money.

West Bridgford Water.—The West Bridgford Urban District Council seek authority to construct water-works, and pump, collect, and distribute water. The works comprise a pumping-station and well in the parish of Holme Pierrepont, in Nottinghamshire, a reservoir in the parish of Edwalton, three conduits, and an occupation road. It is proposed to acquire from the Corporation of Nottingham so much of their water undertaking as is situate within the district of the Council, carry it on, and improve and extend it where required. Borrowing powers will be applied for.

Widnes Corporation.—Further powers with regard to their gas and water undertakings will be applied for by the Widnes Corporation. Among other things they wish for authority to sell and let on hire, or otherwise deal in, fix, and repair, gas and water meters, pipes and fittings, engines, stoves, lamps, and other apparatus incidental to the supply, use, and consumption of gas and water, and to exclude them from liability to distress or to be taken in proceedings in bankruptcy; also to use prepayment meters, and fix the charges for gas supplied through them. With regard to the water undertaking, the Corporation desire to be empowered to hold, maintain, and improve, until required for water-works purposes, the lands belonging to them at Pex Hill, and to apply thereto the provisions of the Public Health Acts, 1875 to 1907, relating to parks and pleasure-grounds. It is proposed to repeal, alter, or amend the Widnes Improvement Act, 1867, and the Widnes Local Board Act, 1875, with respect to the gas and water works funds, revenues, or profits, and provide for the formation and application of the depreciation, renewal, and reserve funds.

LEGAL INTELLIGENCE.

HOUSE OF LORDS.—Monday, Nov. 18.

(*Before the* LORD CHANCELLOR *and Lords* HALSBURY, MACNAGHTEN, *and* ATKINSON.)

Cleverley and Others (Paupers) v. Gaslight and Coke Company.

This was an appeal from an order of the Court of Appeal, dated the 10th of June last, setting aside a judgment and award of Deputy-Judge Macpherson, made under the Workmen's Compensation Act, 1897, whereby he adjudged that the respondents should pay to the appellants the sum of £249 12s. and costs. The appellants were the widow and children of James Cleverley, who at the date of the accident was in the employment of the respondents at the Beckton Gas-Works. The result was briefly recorded last week (p. 578).

Mr. W. GRIST HAWTIN appeared for the appellants; Mr. DANCKWERTS, K.C., and Mr. A. NEILSON represented the respondents.

It appeared that on Feb. 11, 1905, James Cleverley, while in the course of his employment, received injuries to his chest, back, and neck by a fall caused by the breaking of a piece of iron. On the 3rd of March, he was admitted to the London Hospital, where he was found to be suffering from tumours or swellings on the neck; and an operation was performed upon him. From the date of the accident, the respondents continued to allow him half his usual wages; and on March 15, 1905, they agreed in writing to pay him 18s. a week so long as his incapacity lasted. Under the provisions of the Workmen's Compensation Act, a memorandum was sent to the Registrar of the Bow County Court, and was duly entered by him. Cleverley was unable to do any work up to the date of his death, which occurred on March 26, 1906. On the 12th of July following, the appellants, as dependants of Cleverley, applied for compensation under the Act. Before the Deputy County Court Judge, the respondents contended that the death was not the result of, or accelerated by, the injuries received by the deceased from the accident. In his judgment, his Honour expressed the opinion that the medical evidence did not satisfy him that the death was caused, or to any appreciable extent accelerated, by the accident, but when the agreement was made, and down to the time of his death, the sole cause of Cleverley's incapacity was lympho-sarcoma, from which he was suffering, and of which disease alone he died. He held that respondents were estopped from denying that the disease which caused the death was the result of the accident; and he made an award in favour of the present appellants. This decision was reversed by the Court of Appeal, who ordered that an award be entered in favour of the respondents, with costs. From this order the Cleverley dependants appealed, *in formâ pauperis*, and asked for the judgment and award of the County Court Judge to be reinstated.

Mr. HAWTIN argued that it was not for the dependants to prove by their own evidence that the death was the result of the accident, because it was an agreed fact by virtue of the estoppel, and could not be disputed. All they had to do was to connect with the cause of his death the injuries from which the man was undoubtedly suffering. The respondents admitted that the man was suffering personal injury by accident, and this view was accepted by the Court of Appeal; and, so far as the memorandum was concerned, it was an admission that he was suffering from personal injuries the result of the accident. The learned County Court Judge apparently had not said that the accident itself was the cause of the disease; but he was satisfied that the disease from which Cleverley was suffering was the sole cause of his incapacity and death. He submitted that the agreement was equivalent to an award, in which the respondents would be estopped from denying that they were liable to pay compensation, in accordance with section 1 of the Act, for personal injuries arising out of, and in the course of, the employment. The document was an admission of liability generally to pay compensation, apart from the question of how much or to whom it was to be paid. The dependants had no greater or less right than the workman himself. He submitted that they were entitled to come forward and claim compensation; and if there was a liability to pay it generally, the question could not be raised again after it had been decided, whether by agreement or by award. Undoubtedly they would have to prove that the death was the result of the accident; but this would be satisfied if they could prove that the particular injuries which were the result of the accident caused the death. The agreement imported that, whatever was the state of incapacity from which Cleverley suffered at the time the document was signed, it was admitted that it was due to the accident. That state of incapacity was caused by lympho-sarcoma; and therefore there was implied liability, admitted by the Company, to pay compensation for the death.

At the conclusion of the argument for the appellants,

The LORD CHANCELLOR said: We do not require to hear you, Mr. Danckwerts. The learned Counsel for the appellants has put forward all the arguments that could possibly be advanced on behalf of his clients. He was naturally anxious to secure some provision for these dependants; but, in my opinion, this appeal must necessarily be dismissed. The learned County Court Judge has found that the death of this unfortunate man was not proved to have been caused or accelerated by the accident, but was due to another cause—namely, an obscure disease. Finding this, however, he has stated his opinion that an estoppel prevailed which would still entitle the dependants of the workman to compensation, arising out of the agreement or out of the memorandam dated the 15th of March, 1905, which undoubtedly amounted to an admission of something. This memorandum was an admission that there had been an accident, and that the Company were liable to pay compensation as long as the man was thereby incapacitated. It was not an admission that the death, which indeed had not then occurred, was due to the accident, or indeed that any particular consequences following from the accident. It was only that an accident had occurred for which something was payable. Assuming this memorandum to be, on the highest authority, equivalent to an estoppel by record, it is impossible to extract from it an admission of the fact (the contrary of which was found by the learned Judge) that the man's death was due to the accident. Under these circumstances, I respectfully advise your Lordships that this appeal must be dismissed.

Lord HALSBURY expressed a similar opinion. He said the County Court Judge had found as a fact that the man's death was neither caused nor accelerated by the accident; and therefore it was impossible to overrule this by the somewhat circuitous process which had been suggested.

Lord MACNAGHTEN and Lord ATKINSON concurred.

The appeal was accordingly dismissed.

COUNTY OF LONDON QUARTER SESSIONS.

SESSIONS HOUSE, CLERKENWELL.—Wednesday, Oct. 30.

(*Before Mr.* R. LOVELAND LOVELAND, K.C., *Chairman, and a Bench of Justices.*)

Metropolitan Water Board v. Assessment Committee of the City of London Union.

To-day the hearing was resumed of the appeal by the Metropolitan Water Board against assessments by the Assessment Committee of the City of London Union, at the quinquennial valuation of 1905, in respect of 101 out of the 114 parishes contained in the Union. The earlier proceedings will be found reported on pp. 503 and 579.

Mr. DANCKWERTS, K.C., Mr. HORACE AVORY, K.C., and Mr. BOYDELL HOUGHTON (instructed by Mr. Walter Moon) appeared for the Water Board. The Counsel for the City of London Union were Mr. BALFOUR BROWNE, K.C., Sir EDWARD BOYLE, Bart., K.C., M.P., and Mr. WALTER C. RYDE (instructed by Messrs. James White and Leonard). Mr. BALFOUR BROWNE and Mr. WALTER RYDE appeared on behalf of the Greenwich Union; Mr. W. C. RYDE, Mr. COX SINCLAIR, and Mr. BICKMORE, for the Woolwich Union; Mr. CUNNINGHAM GLEN and Mr. A. BETHUNE, for the Holborn Union; Mr. MORTEN and Mr. SAUNDERS, for the Borough of Islington; and Mr. COURTHOPE MUNROE, for the Borough of St. Pancras.

Mr. BOYDELL HOUGHTON, at the opening, stated that Mr. Danckwerts was not well enough to be present and continue the case that day; and he then proceeded to read some correspondence which had passed between the parties since the last adjournment. It will be remembered that at the previous hearing Mr. Danckwerts handed to Mr. Balfour Browne a valuation that had been made of the whole of the unproductive portion of the undertaking, but only on condition that the figures were not published, as they referred mainly, of course, to other parishes than those concerned in the present appeals. As there were some half-dozen other appeals against assessments by different Unions which it had been arranged should be held over pending the hearing of the City of London case, it was suggested (on the Court intimating privately to Counsel that they were at present of opinion that the undertaking should be valued as a whole, and then distributed into the various parts) that the Unions should combine together and value once for all the whole of the Board's works, so as to check the figures which had been put forward by Mr. F. C. Ryde from valuations of different portions made by himself and Messrs. H. E. Jones, Corbet Woodall, and Arthur Valon. The proposal of the Court was that then all the Unions should come into the City of London case and cross-examine the witnesses who had valued the concern as a whole for the Board. The letters read, however, were to the effect that the respondents had decided not to go to the expense of valuing the whole of the unproductive works for themselves, but to rely upon their cross-examination of the Board's witnesses, and to give evidence of value upon what the respondents were advised were correct methods, so as to enable the Court to state a case.

Mr. MORTEN remarked that the arrangement come to at the last sitting had placed Islington in a difficulty. There had from the first been an understanding between the Board and Islington that their appeal should stand over until after the hearing of the City of London case. He asked, therefore, to be relieved of attendance during the present proceedings, without prejudice to Islington's rights. It seemed, he said, absurd to go to the expense of appearing there for a purpose which might be foreign to anything which arose in their appeal.

The CHAIRMAN pointed out that the Court were asked to suspend judgment in the City of London case until after they had heard all the others. Was Mr. Morten willing to be bound by any judgment in the City case?

Mr. MORTEN replied that he was not in a position to assent to that;

but his clients did not want to spend any more than was necessary on their appeal.

The CHAIRMAN: Have you considered what would be the least expense—whether you should (as you have a right) re-open the whole question with regard to Islington after the case of the City is closed, or whether you would be here (say) for a day or a portion of a day, to cross-examine upon the evidence put in by the City of London, or rather by the Metropolitan Water Board?

Mr. MORTEN: The difficulty is that, as far as we are concerned, we are not in a position to cross-examine, because we have had no valuation made. We have stood by and have done nothing, because the understanding was that we should stand by and do nothing. We do not want to come here and re-try the whole case afterwards. All we should want to re-try would be as much as was particularly applicable to Islington, and which did not affect the City of London—I mean any general principle established in this appeal. May we go without prejudice to any question that may arise in this appeal?

The CHAIRMAN: Yes.

Mr. COURTHOPE MUNROE: I make a similar application on behalf of the Borough of St. Pancras.

The CHAIRMAN: Very well.

Mr. HORACE AVORY (after Counsel and the Bench had conferred) said they would proceed now on the lines indicated at the last sitting, by calling the Engineers.

Mr. *H. E. Jones*, examined by Mr. BOYDELL HOUGHTON, said he had been engaged in appeals of the late London Water Companies in 1895 and 1900. The whole undertaking of the Board had been valued for the present appeal; Mr. Corbet Woodall, Mr. Arthur Valon, and himself each taking a portion. Witness took the northern part—the valley of the Lea, the valley of the New River, and all the works connected therewith. Asked upon what principle he had made his valuation, he replied that where the machinery and buildings had been put up in the last ten or fifteen years, he was able to get from the books of the Board the precise cost. This placed the matter beyond all dispute. Where the older works were concerned, he did as he had done on two previous occasions for the Grand Junction and the East London Water Companies. He took a certain value as representing the reasonable cost of replacing or doing the same work with equal efficiency upon modern rates of expenditure, current rates of wages, and so on. In valuing the street mains and pipes, he had included the cost to-day of the metal pipes, and the cost of restoring the paving according to the class of the street surfaces. The whole of the properties he valued, excluding land, amounted to £3,923,813.

Cross-examined by Mr. W. C. RYDE, witness said that with regard to valuing the old engines, he had estimated the cost of putting up equally efficient engines to do the same amount of pumping as the existing ones. For modern engines of equal efficiency the cost would be much less. As to the buildings, he had taken these at so much per cubic foot. It was true that if modern engines were substituted, they would not want such large buildings; but they would have to be more expensive ones. His prices per cubic foot were 8½d., 10½d., 11d., 1s., and in one case—a modern house—1s. 3d. As to the mains, these had been averaged out according to the lengths; and he had added to the ordinary cost of the cast-iron pipes the cost of breaking up and replacing the gravel, concrete, wood, or granite setts. Supposing a main was laid thirty years ago in what was then a gravel or macadam road, and twenty years later wood paving was laid on the top, the capital value which he had made the basis of his valuation was that of a main laid in a wood-paved road—debiting the main with the cost of breaking up and replacing the concrete and the wood paving—because this would be the cost to-day of putting the main in that position. The sum he added in respect of this consideration might raise the price from 1s. 2d. to 21s. per yard run. His valuation for mains was £4,730,124. The mileage of the mains was ascertained from the books of the Board; and then the Engineers gave Mr. F. C. Ryde average prices. The prices of the different dimensions of mains, including the paving over them, varied from 7s. 9d. per yard for 6-inch pipe, to 138s. per yard for 54-inch. To go over every yard would take two years.

Mr. RYDE: How did you arrive at the average price between macadam, wood paving, granite setts, and asphalt?

Mr. HORACE AVORY: I think I can save time, if the witness will allow me to remind him of something. Mr. F. C. Ryde is really responsible for these figures about the mains. He adopted this principle, which the Engineers, including Mr. Jones, approved—namely, to assume that the mains in the London area are laid under paved roads, and to assume that the mains outside the London area are laid in roads which are not paved; the result being, of course, that there may be an injustice, which is balanced one against the other. It may be there are roads in the London area which are not paved, and that there are roads outside which are paved; but they all came to the conclusion that the only way to do it practically was to make this assumption, and therefore the calculations were on that basis. The County of London was taken as the London area.

Further cross-examined, witness said he could not make any estimate of the lengths of the mains that were laid in macadam and were valued on a different basis because there was now wood paving on the top. Certainly wood paving was not extensively adopted thirty years ago; but there were then expensive pavings, because 10-inch granite pitches and 12 inches of cement and concrete were very costly. He should think that in the valuation there was a very small amount added in respect of this claim to value the state of things as now existing. Certainly it would not be £2,000,000 out of the £4,730,124. He did not know what proportion of the mains was in the County of London. The cost of laying a 20-inch main under macadam would be from 2s. 6d. to 3s. 6d. a yard run; while putting it under wood paving would cost something like 18s. a yard. He had valued the engines as though they were fully in use, because he supposed they were necessary or they would not have been erected; and the same thing applied to the reservoirs, which were part of the whole scheme of storage. He did not think he had valued any works in the Holborn Union.

Mr. CUNNINGHAM GLEN then applied, on behalf of the Holborn Union Assessment Committee, to be relieved from further attendance for the purpose of cross-examination. He said the interest of his Union was mainly in the value of the directly productive portions of the undertaking within their area, which were very considerable. When the principle had been decided in the case, it would no doubt govern their appeal; and the parties might come to a settlement.

The CHAIRMAN: Do you wish to argue the main question whether the undertaking is to be considered in parts or as a whole? If eventually we should be of opinion that it is to be rated as a whole, it might become of importance to all of you to cross-examine the witnesses. Then we should have a repetition of the whole thing over again. We are very much hampered in not giving our judgment at once, as we were prepared to some months ago. We were asked to withhold our judgment on the principle until all the parties could be heard. Now they do not want to be heard until this appeal is finished.

Mr. HORACE AVORY: I shall certainly suggest that, before the Court finally gives judgment on the question of principle, all the parties shall be invited to attend and say anything they have to say, so that they shall be bound eventually by the decision of the Court on the question of principle. If they are going hereafter to argue in this Court the question of principle, they must now cross-examine, if they desire to cross-examine on any point which affects the question of principle. They must not say afterwards that they never had the opportunity of cross-examining witnesses in order to establish their argument.

Mr. CUNNINGHAM GLEN intimated that he was inclined to agree with this view; and as he understood that Mr. Ryde was to be re-called for further cross-examination by Mr. Balfour Browne, he proposed to confine his questions on the point of principle to that witness.

Mr. RYDE, who appeared for Greenwich and Woolwich (besides the City of London), said that for the moment he had no questions to put to Mr. Jones on behalf of these Unions. He agreed with the proposition that if he did want to ask anything of the Engineers, when they were called was the time to do it.

Mr. *Corbet Woodall*, examined by Mr. HORACE AVORY, said he was concerned for the Southwark and Vauxhall Water Company, in 1904, in preparing the valuation of their property for the purposes of the arbitration; and in connection with the present appeal he inspected all the stations in the southern district of the Water Board—the area which belonged formerly to the Southwark and Vauxhall and Lambeth Companies. In doing this, he had had regard to the value of the works to a tenant; and wherever possible he had checked his valuations by the actual prices paid for the machinery—which he had been able to do in a considerable number of cases. The value of the land he had taken from Mr. Ryde; and as to the unproductive mains, the cost of these, including laying and so forth, was given by Mr. W. B. Bryan, the Chief Engineer to the Board. Witness checked them very carefully in the light of the experience he had had of laying gas and water mains; and he said that, in his opinion, they were fair and proper prices. It would be a very heavy job to measure and value the actual mains as laid in each street, having regard to the particular kind of paving they were laid in; but if the main plans of the Board were kept up to date, it could be done. The totals of witness's figures were £1,833,603 in the Southwark and Vauxhall division, and £961,072 in the Lambeth—together £2,794,675.

In cross-examination by Mr. RYDE, witness said he was aware that there were many miles of streets in the Southwark and Vauxhall district which had wood paving; but he should doubt whether this had all been put down in the last thirty years. He did not question how many yards or miles should be taken as under wood, and how many under macadam. This was not in any way referred to him. He valued the whole of the filter-beds that were built, though at the time one or two of them were not actually in use. An average value had been put on them all. In regard to the engines, he had adopted the same method as Mr. Jones. New engines he had taken at cost; and with old ones, he had asked himself what it would cost to substitute a new and equally efficient one for the existing engine. A new engine would require a smaller building to house it, though the ground area might be at least as large; and in any case it would be an extravagant thing to pull down an existing building and put another up in its place. He had had to value new engines that were not in full use; and he had taken the buildings in which they were accommodated. In fact, he had valued the existing buildings at their structural value; and the old engines on the basis of what it would cost to substitute new ones for them, because it was very difficult to get at the cost of the old engines, which must have been exceedingly high. He had not checked his valuation by any figures of actual assessments, and did not know whether his figures were double or half of what the assessments were.

Re-examined by Mr. HORACE AVORY: The reason why, in the case of old-fashioned engines, he had substituted for the purpose of his valuation a new and modern engine, was that it would hardly be reasonable to expect a tenant coming in now to take over an old and costly engine at its original price. Though, however, a new tenant might prefer a modern engine, witness was not sure that he would, unless the existing ones had been worn to an extent that they showed no signs of at present. Those he referred to were in beautiful order, and excellently kept; and he should doubt very much whether any reconstruction would take place even if a new tenant came in. But the tenant would probably say that it was an extravagant thing to take over those very costly engines at their original price. These being unproductive works, by substituting a new and less costly engine, they were giving the respondents a benefit. If a tenant came in and found an old engine erected in a building, even though he might think it was worth while to substitute a new engine, he certainly would not dream of pulling down the old building simply because it was too large for his new engine. The same thing would apply to a landlord.

Mr. *Arthur Valon*, in answer to Mr. BOYDELL HOUGHTON, said he had, in conjunction with his father, Mr. W. A. Valon, made a valuation of a part of the undertaking. Originally it was intended to call his father; but he was indisposed. Witness, however, was in a position to speak from his own work as to all the figures contained in the valuation. They had made a structural valuation in the western district—Chelsea, Grand Junction, Kent, Staines, and West Middlesex. In doing this, they had acted on the same principles as had been described by Mr. Jones and Mr. Woodall, except that he thought in

regard to the engine-houses they did make some allowance where an engine was fixed in an old-fashioned house which would not have been replaced. They took it that the new engine would have a new house at a lower cost, and valued the existing house accordingly. So that they had given the respondents a little further benefit than the two previous witnesses had done. At the same time, it was, of course, exceedingly unlikely that a tenant or a landlord would pull down an engine-house because it was too large. The total of the portion of the undertaking they valued was £3,373,210.

In cross-examination by Mr. RYDE, witness said that, with regard to the engine-houses, the reason why he had made an allowance was that the tenant could not be expected to give a larger rent than such a sum as would be calculated on the cost of putting up an equally effective engine and an equally effective house. If an engine with its house could be erected to-day for £50,000, he would not calculate the rental value at any percentage on (say) £100,000, which the actual building and the engine *in situ* might have happened to cost. His firm had nothing to do with saying what portion of the mains should be valued as under wood, and how much under macadam. All they did was to give an opinion upon the prices that were submitted to them. They did not consider the question whether the prices were going to be applied to a yard, a mile, or fifty miles. The object of the valuation in which he had helped to take part was to find out on what sum the annual value was to be calculated for the unproductive works on the Water Board's system.

Mr. RYDE: That annual value, when arrived at, is to be a deduction rom the whole. If this annual value happens to be £500,000 above the assessment in the several valuation lists, the Board will get off £50,000 of rating, will they not?

Witness: Not necessarily, surely.

Mr. HORACE AVORY: That is not a question for the witness.

Cross-examination resumed: The object of his valuation was to find out the value of a part of the whole concern. The remaining portion did not concern him. He knew that any figure which was arrived at would be used by way of deduction from the total value of the whole undertaking.

Re-examined by Mr. HORACE AVORY: He was aware that the appellants were also putting before the Court a valuation based upon the capital value of the whole concern, and taking 3½ per cent. on this to get at the rateable value, and that this valuation of his of a portion of the unproductive works formed part of the total valuation for capital value on which the appellants were relying. In the case of the capital value which they were putting forward, and taking 3½ per cent., it was to their interest to put the amount as low as possible. In arriving at the value, his father and he paid no regard to the method by which the rating would be fixed. They simply made as accurate a structural valuation of the concern as they could, without any regard whatever to what it was to be used for.

Mr. HORACE AVORY: Your Lordship follows, I hope, what I am putting to the witness, because it is obvious that it is not to our interest to increase the structural value of the unproductive works, inasmuch as if we do we are increasing the capital value on which we are basing our other calculation.

The CHAIRMAN pointed out that the appellants had based their own figures upon profit earnings; and the Court could not go below their figure of £32,000, which was based upon the valuation of the entire undertaking. He could not see that all this question of capital value had anything to do with it. He thought the appellants were bound by their own figures. In the absence of any information as to the appellants' accounts, the Assessment Committee had been obliged to estimate the value of the property based on the accounts of one of the Companies—the Company who had supplied this particular water through the City. So that both sides had gone on the accounts.

Mr. BALFOUR BROWNE remarked that he was bound by the decision of the Court to treat the whole concern as one undertaking, though he had intended to argue the reverse.

The CHAIRMAN: Then I understand, also, that the gross receipts of the whole undertaking are agreed by both parties?

Mr. BALFOUR BROWNE: I should think there could be no dispute about the gross receipts.

Mr. HORACE AVORY: The gross receipts of the whole undertaking are agreed, no doubt, or at any rate, they should be. The gross receipts in the City parishes concerned in the appeal are also agreed.

Mr. BALFOUR BROWNE: I do not require Mr. F. C. Ryde back now on the City case.

Mr. *W. P. Ryan*, examined by Mr. HORACE AVORY, said he had investigated the whole concern, both on the basis of 3½ per cent. on the structural value and on the Water Board's accounts for the year to March 31, 1906. Taking the second table first, the gross receipts were agreed at £2,760,632; and working expenses, *ex* rates and statutables, £659,997. This left an amount divisible between landlord and tenant and for rates of £2,100,635; and deducting the tenant's share, £220,851, there was a figure of £1,879,784. Taking from this the statutable deductions, £280,572, there was left a rateable value, *plus* rates, of £1,599,212. Deducting from this the rateable value, *plus* rates, of the indirectly productive part, £1,053,950, he arrived at a rateable value, *plus* rates, of the directly productive plant of £545,262, or equal to 19·751 per cent. of the gross receipts. His rateable value for the entire undertaking (£1,599,212, less rates at 6s. 9d. in the pound, £403,539) amounted to £1,195,673. The gross receipts in the 101 parishes appealed against were £144,515; and the rateable value, *plus* rates, of directly productive mains, calculated at this percentage (19·751), was £28,543. Deducting rates at 7s. in the pound, £7400, there was left a rateable value for the directly productive mains of £21,143; and adding to this the value of the indirectly productive mains, £1748, the total rateable value in the 101 parishes was £22,891. To this he added for repairs, insurance, &c., £5723, making the total gross value £28,614. His figure for the indirectly productive parts depended upon the Engineers' valuation of the works and mains. Assuming this method to be the proper basis for calculation, the £28,614 represented in his judgment the gross value in these parishes. He was decidedly of opinion that the undertaking ought to be rated as a whole; he did not see how it could possibly be done on what was commonly called a parochial assessment.

Mr. HORACE AVORY: On what principle was your other valuation based—3½ per cent. on the structural value distributed according to gross receipts?

Witness: That was a method. It is difficult to find any particular method of distributing which would be fair to all parties. If it is decided that the proper basis of valuation for rating purposes on the whole is taking it at structural value at a percentage, then it is rather difficult to hit on a proper method of distribution which would be fair to all parties. As far as the Water Board are concerned, of course, it does not matter how it is distributed; and this is a method of distributing it in ratio to gross receipts in the various parishes where the Board have property. The method set forth here is that the rateable value of the entire undertaking at 3½ per cent. comes to £630,000. Deducting from this the rateable value of indirectly productive parts, also at 3½ per cent., on a value of £15,932,407 (£557,634) leaves a balance for the rateable value of the directly productive part of £72,366, or 2·62 per cent. of the gross receipts. Then applying that to the particular case of the City of London, you find the gross receipts for the 101 parishes to be £144,515; and the rateable value of the directly productive mains, taken at 2·62 per cent. on that figure, gives £3786. I add to this the rateable value of the indirectly productive mains, £1223, which will give a total value in the 101 parishes of £5009, to which I add for repairs, insurance, &c., £1281, making a total gross value of £6290.

The CHAIRMAN said £32,000 was the figure mentioned by the Board in the appeal; and the Court could not go below that. In all the number of years he had sat, he had never felt that he had had the power—and certainly he had never exercised it, if he had it—of going below the figure asked for by the appellant. He did not think he had the power.

Mr. HORACE AVORY: All I am at present saying is that, so far as I know, there is no statute and no rule of law which prevents an appellant proving something less than his notice of appeal, or which prevents the Court adopting a figure less than his notice of appeal.

Mr. BALFOUR BROWNE here interposed with the remark that he had never seen any Court adopt it.

In cross-examination by Mr. BALFOUR BROWNE with regard to his valuation on profits, witness said he had taken the tenant's share as 8 per cent. of the gross receipts—the same as Mr. Ryde. It had not been a universal practice to take 17½ per cent. in water-works. In fact, in such cases it was not at all uncommon to take 10 per cent. of the gross receipts. There was nothing in the 17½ per cent.; it was not something that could not be departed from. He did not know that the gas-works dealt with in that Court had always been put at 17½ per cent. After arriving at the rateable value of the whole undertaking, he took off the value of the unproductive part, before distributing the amount among the parishes. They had only to distribute the value of the directly productive works. There might be a parish in which there was no indirectly productive plant at all; but this would make no difference. The proportion would be deducted in that case, the same as in others. To argue differently would be the same as saying that because a parish had no station in it on a railway, one was not to make any deduction for stations. It was, of course, the case that the indirectly productive plant varied in different districts; but it was for the benefit of the whole undertaking. He was informed that the Kent district had taken a considerable quantity of water from the Staines reservoirs, for instance, although part of the supply was drawn from wells. It was a fact that the Kent wells drew water from underground, and that it was not stored on the surface; while the Thames and New River water had to be stored in expensive reservoirs.

Mr. BALFOUR BROWNE: Why, therefore, should you go and reduce the rateable value of a parish in Kent because an important reservoir has to be provided at Staines, or wherever the other reservoirs are?

Witness: On precisely the same principle as, if you are dealing with a railway company's line, and you have got in a small parish in Cumberland a station worth £20 a year, you have to deduct from the parish a proportion of the rateable value of the stations here, at King's Cross or Euston, as the case may be.

Cross-examination resumed: If a district did not get, or require, any water from the Staines reservoirs, then it would be an entirely separate undertaking, and ought not to be saddled with the cost. But if, on the other hand, it was an advantage for to-day and for the future to be connected with Staines, then the district ought to be charged.

In cross-examination by Mr. CUNNINGHAM GLEN, witness admitted that his method was really on the assumption that every pound of gross receipts cost the same amount of money to earn. Possibly separate assessments in the Holborn Union were very much higher on the average than in some of the outlying places. If they supplied the same quantity of water to a building in Holborn that was supplied to another building in a parish where the rateable value was much lower, the gross return for the water would be much larger in Holborn; but the net return might be less, because the expenses of supplying water might be greater in one case than the other. He did make an effort to ascertain what were the expenses in the City of London, what was the cost of supplying the water, and what was the quantity of water supplied; but he found it absolutely impossible. He defied anyone to find out what the actual expenses in the City were, or what was the quantity of water supplied. He agreed that the effect of his valuation was to disregard any difference in the cost of working in the City—if there was any difference.

Re-examined by Mr. HORACE AVORY: The object of his calculation was to find the proportion which the directly productive part bore to the gross receipts; and in order to do this it was necessary to deduct the unproductive part. As to his percentage for tenant's capital, he had dealt with gas-works where 17½ per cent. on the actual tenant's capital would not give even £1 a week. No one would undertake to carry on a gas-works for £1 a week. Then it had been discovered in the case of some gas-works that 17½ per cent. was a great deal too much. The figure must vary in each particular case. No tenant would work such a concern as the Water Board's, unless he got £220,000 out of it. This would be the smallest sum; and it would only represent a very slight return on his capital. His rough-and-ready rule was to allow 10 per cent. on the gross receipts of water companies, unless there was something to alter the circumstances.

MAESTEG RESERVOIR CONTRACT.

Liability of the Urban District Council for Damages.

Mr. Muir Mackenzie, one of the Official Referees, has given his decision in a case on which he was engaged for several days. It was an action brought by Messrs. Jones and Son, a firm of contractors at Neath, against the Urban District Council of Maesteg, in Glamorganshire, to recover a sum amounting to about £44,000 as damages for preventing them from completing a reservoir for supplying the town of Maesteg with water, which the defendants had employed the plaintiffs to construct for them. The case raised questions of considerable importance to municipalities and local authorities who control undertakings for the supply of water.

Mr. Acland, K.C., and Mr. G. W. Ricketts appeared for the plaintiffs; Mr. S. T. Evans, K.C., M.P., and Mr. C. C. Hutchinson represented the defendants.

The case as opened by the plaintiffs' Counsel was that in 1903 the defendants, as the Local Authority for the district of Maesteg, required to increase their water supply, and employed the plaintiffs to construct a reservoir in the hills adjoining the town, by means of a dam built principally of puddle clay and concrete, which was to form a lake by impounding the water which came down from the hills. The contract price was to be about £30,000, together with such additional sums as might become payable for increased excavation or other circumstances incident to the character of the site chosen for the reservoir, and further sums which might be occasioned by difficulties in obtaining suitable clay puddle. After the works on the reservoir had proceeded for a certain time, the defendants were advised that they could not be completed for anything like the price originally contemplated, but would involve the expenditure of sums in excess of any amount which the Local Government Board would allow the defendants to raise by way of loan on the security of the rates. Having arrived at this conclusion, they gave notices to the plaintiffs prohibiting their continuing the work, and ordering the removal of their plant. The plaintiffs said there was no justification whatever for this proceeding, and submitted that they were in consequence entitled to compensation for loss of money expended in the supply of plant and materials and the payment of wages, as well as for loss of profits which would have been made had they been allowed to complete the reservoir.

The first witness called was Mr. W. Gordon Jones, a member of the plaintiffs' firm, at the conclusion of whose evidence other witnesses were called to corroborate his statements and substantiate the particulars of damage. The plaintiffs' case was much strengthened by Mr. Ralph Wyrill, the Water Engineer to the Swansea Corporation; Mr. William Watts, a Past-President of the Association of Water Engineers; and Mr. Baldwin Latham, M.Inst.C.E.—all unanimous in expressing the opinion that the site chosen was suitable for its purpose, and that the faults to be observed in the strata were too far from the actual bed of the reservoir to be harmful.

On the conclusion of the plaintiffs' case, Mr. Evans addressed the Official Referee on behalf of the defendants. He said the contract divided itself into three periods: (1) The period before the Council suspended the work; (2) the period during the suspension of the work; and (3) the period since the plaintiffs had been told finally to discontinue the work. With regard to the first, no claim was made except for retention-money; but this was not payable under the contract until the final certificate was given to the Contractor by the Council's Engineer, and this had not been done. As to the second period, he submitted that the plaintiffs had already received a very large sum of money—in fact, all they were morally entitled to. But, apart from this, he had two complete legal defences to put forward; for, in the first place, the agreement pleaded by the plaintiffs was not under seal as required by the Act, and, secondly, the contract itself allowed for suspension. With regard to the total cessation of the work, he submitted that he was again protected by a clause in the contract which allowed the defendants to instruct the plaintiffs, through their Engineer, to omit any portion of the work. This, he maintained, was not an unreasonable construction to put upon the clause; for it could not be supposed that a local authority in the position of defendants would be obliged to continue in a course involving the expenditure of a vast sum of money to complete their contract, and would be unable to do their duty as a public authority and say they would embark no further upon this loss. The learned Counsel then proceeded to consider the question of damages, if the Court should hold that there had been a breach of the contract. It appeared that the two main items in dispute were the excavations below the depth marked on the plans, and the question of suitable clay to be used for the foundation of the dam. On the first of these, it was contended that experience in this class of work showed that no one would ever contract on the basis that such a line was a fixed and determined depth, in no way liable to be varied if the nature of the strata required it. In making his price, a contractor would take into consideration the chance of being obliged to excavate deeper; and it would be for the engineer to say when he considered a good basis for the foundation had been reached. With regard to the clay, it was admitted that the price had been fixed at a meeting of the Council and Mr. Jones; but this did not bind the Council as to where the clay was to be fetched from. The claim had been made upon the basis that all the clay used was to be brought from Cwrt Sart—a distance of 12 miles from the site—and also that, with the exception of a small layer of concrete at the bottom of the trench, the whole of the trench was to be filled with clay. This it was submitted was not a correct basis, as the Council were not obliged to obtain all the clay from this spot, nor have the trench entirely filled with this material. In fact, this was in the discretion of the engineer; and it was shown by the plaintiffs' own witnesses that, but for the contingency of coal being mined below the dam, concrete would be a better substance than clay with which to fill the trench. He would call expert witnesses to prove that not only was it extremely unlikely that coal would ever be taken from these seams, but also that, owing to the great depth to which it would be necessary to sink for it, even if coal were removed, there was only an inconsiderable chance of subsidence taking place.

Evidence for the defendants was then given by Mr. Gibbon, the Chairman, and Mr. R. Scale, the Solicitor to the Maesteg District Council; Mr. R. H. Tiddeman, who had been employed for many years on the Geological Survey of Great Britain, and had had experience of the district in which the reservoir was situated; Mr. James Diggle, Assoc.M.Inst.C.E., the Engineer to the Heywood and Middleton Water Board; and Mr. R. E. Middleton, M.Inst.C.E., an Assistant-Commissioner in connection with the inquiries into the Metropolitan Water Supply conducted prior to the transfer of the undertakings to the Metropolitan Water Board, and Consulting Engineer to the defendants The last-named witness stated that in September last year he advised the Council to give up the undertaking permanently, as he considered that, even if a dam were built, the reservoir would never be watertight. On giving notice to the Contractors to discontinue, he had directed the work done to be measured up, and, having computed its value from these measurements, he reported to the Council that the total, including the retention-money, was £18,986 7s. 2d. The Council had already paid £21,648; so that the Contractors were overpaid to the extent of £2000. The difference in figures was due chiefly to corrections he had thought it necessary to make in certificates which had been previously given by the Council's Surveyor and Engineer before his appointment in August, 1906.

At the close of the evidence for the defendants, Mr. Evans addressed the Official Referee on their behalf. He contended that by the terms of the contract the Council were entitled to put an end to the work; and if there had been any *malâ fides* in their mode of exercising this power, the Contractors would have had their remedy. Mr. Acland, who followed for the plaintiffs, submitted that there had been a breach of the contract. He said the contract had never been one for the construction of a water-tight reservoir; for Messrs. Jones had all along avoided this responsibility. They had contracted to do certain things—to excavate a trench, fill it with puddle clay, and construct a stable dam. These things they were prepared to do; and if leakage had occurred through faulty workmanship, they would have taken the responsibility, as they were bound to do under the contract. The real fact was that the Council found they were spending more money upon the works than they had expected to do, and they got frightened; so they thought the quickest and best way out of the difficulty was to throw over the whole contract. The clause relied upon by them to justify this proceeding could not, he submitted, be construed to cover their conduct; for the words, "such alterations, additions, and omissions as the Council, acting through its Surveyor, shall think fit," could not possibly be construed to apply to the omission of the whole of the remainder of the work.

The Official Referee reserved judgment, which he delivered on Monday last week. Having indicated the nature of the case, and reviewed in detail the evidence tendered, he said the contract entered into by the parties did not contain any express authority to suspend the work, though there was power to make deviations and omissions. On July 28, 1905, a resolution was passed to suspend the work, with the exception of that relating to keeping down the water in the trench; and the Contractors were asked to give their price for this. In reply, they pointed out that they would incur expense by the suspension. Passing to the negotiations between the parties respecting getting clay from Cwrt Sart, he said that all this time the plaintiffs had insisted on their rights to the expenses they had been put to by the suspension, and their willingness and readiness to resume work. The defendants, in replying to the charge of breach of contract, contended that in the circumstances that arose it was not practicable to construct a water-tight reservoir on the site as arranged for in the contracts, except by a complete alteration of the designs, which would mean incurring an expense they were prohibited from doing by their statutory powers of borrowing. They also contended that, by the agreement of March 16, 1905, there was no consideration for the promise to pay for increased depth in excavating, nor for the procuring of clay from Cwrt Sart. The original contract and the two supplemental ones were legally executed, and they bound the Council as fully as if they were made between individuals; and there was nothing which made it physically impossible to carry out the work. Coming to the question of compensation, the Official Referee said the estimate of profits must necessarily be somewhat conjectural. The plaintiffs had been put to the expense of obtaining another site for clay, making a railway, and placing wood in the trench. During the period of suspension there was the expense of keeping the trench free of water, and leaving the plant in readiness to resume work at any moment. For part of this they had been paid. As to the re-measurements, he did not adopt the view that the plaintiffs had been overpaid. Having dealt with the profit and loss account, depreciation of the capital value and plant, and other matters of detail, he gave judgment for the plaintiffs for £18,909 8s. 7d.* Although, he said, the defendants' Counsel had reduced the claim by more than one-half, he saw no reason for making any reduction in the matter of costs. There was no doubt as to the liability and damage, and the defendants had throughout fought the case on principle. Therefore he awarded the plaintiffs costs in the action.

* After the delivery of the judgment, the attention of the Official Referee was called by the Counsel for the Local Authority to an error in the amount of the award. Mr. Muir Mackenzie has acknowledged he made a mistake in his addition, and that the amount awarded to the plaintiffs should be £17,909.

Alleged Smoke Nuisance from a Gas-Works.

At the Liverpool Police Court, last Wednesday, the Gas Company were charged with carrying on at their Wavertree works a business which caused annoyance to the residents, without using the best practicable means to prevent such annoyance. The proceedings were taken under the Liverpool Sanitary Amendment Act of 1854. Mr. Duder, who prosecuted for the Health Department, said that the annoyance was caused in connection with a machine operated retort-house, where smoke was allowed access into the house itself, and out through the louvres, there being no chimney. The smoke came out of the pipes

"in thick volumes that looked like black wool," and there were also complaints about the dust and effluvia caused by the smoke, and of a whirring noise from the works. Inspector M'Cawley gave evidence that, visiting the district on Oct. 14, he saw volumes of smoke from the gas-works filling the surrounding streets, which looked as though there was a mist over them. He watched the smoke emitted for twenty minutes. There was also a great noise from the machinery, as if bearings were grinding and needed lubrication. He suggested methods which he asserted would remedy the nuisance; but Mr. Maxwell, for the defence, contended that it was impracticable to employ any different system for the one now adopted. The Stipendiary Magistrate (Mr. W. J. Stewart) questioned Mr. Duder, who said he had no expert evidence for the Corporation. He tried to get several engineers; but for various reasons they would not attend. Mr. Maxwell remarked that the Company had taken the advice of the two best engineers they could get; and they testified that the works were the best conducted and cleanest they knew of. Mr. Stewart said he would not decide the matter that day. If the Company were going to present an absolute non-possumus, by saying they had the best possible works managed by the best possible men in the best possible way, he could not decide. If there were no eminent engineers on the side of the Corporation, he suggested the parties should agree upon an independent expert to form an opinion on which he (Mr. Stewart) would act. Two residents of the district having given evidence as to the annoyance, the case was adjourned for fourteen days, to allow of the parties agreeing on an independent expert or of the prosecution obtaining expert evidence.

Brokers and the Purchase of Second-Hand Gas-Meters.

At Rochdale Borough Police Court, last Wednesday week, a licensed broker named Walter Oddy was summoned for purchasing 2¾ lbs. of tin—being a less weight than that allowed by the Corporation bye-laws. The Chief Constable said that, on the theft of a gas-meter being reported, defendant was visited and asked if he had purchased one; and he replied that he had bought a meter from a man who was subsequently imprisoned for the theft. The register kept by defendant showed that he had purchased the meter for 2s. It was made of block-tin, which was worth about 1s. a pound. It was common knowledge that these old gas-meters would not be purchased for 2s. were it not for this small portion of metal. He read out the section under which proceedings had been taken: "Any dealer in old metals who either personally or by any servant or agent purchases, receives, or bargains for any metal mentioned in the schedule, whether new or old, in any quantity at one time of less weight than the quantity set opposite each such metal in the same schedule, shall be guilty of an offence against this Act." Included in the list of metals in the schedule was "tin, or any composite, the principal ingredient of which is tin, 56 lbs." David Niven, a maker of gas-meters, said that block-tin was always used in the construction of meters of this type. The weight of the tin would be about 2¾ lbs.—worth about 1s. 3d. per pound. In cross-examination, witness admitted that all gas-meters did not contain tin. For the defence, Mr. Molesworth asked for the leniency of the Bench if they did come to the conclusion that the buying of the meter constituted an infraction of the law, for the practice had gone on continuously for years. There was, he said, not the slightest intention on defendant's part to keep back a record of the transaction. He refuted the suggestion that the meter had been purchased for the purpose of being broken up, in order to abstract and sell the tin. The detective called on defendant the day after the transaction, and found the meter intact. Defendant intended to re-sell the meter; and he would perhaps have made a profit of about 1s. 6d. The Act was never intended to preclude a broker buying an article which had a small portion of metal used in its construction. If the Chief Constable was right in his contention, a broker could not buy a boiler with brass fittings, because, according to law, he was not allowed to buy metal in less quantity than that prescribed by the Act. Supposing a man purchased a scythe fitted with two brass knobs. Legally he could not buy the scythe, because of the brass on it. Was it possible to contemplate that the Act of Parliament intended to apply in a case such as he had cited? After a brief deliberation, the Chairman (Alderman Hardman) said the Bench considered the law had been broken. It was the first case of the kind brought into Court; and in these circumstances they had decided to inflict a fine of only 2s. 6d. and costs. Mr. Molesworth asked the Bench to state a case, as the point at issue was of great importance to all brokers. He could not find any record of a case. The Magistrate's Clerk said there was no case at all.

Electric Light Failure.—During the performance of the military play "Second to None," at the King's Theatre, Hammersmith, on the 16th inst., the stage was plunged in darkness for some minutes, until the footlights and wings were illuminated by gas, owing to the failure of the electric light. The owner and manager (Mr. J. B. Mulholland) took the opportunity, between the acts, of apologizing, in a witty little speech, for "the light that failed"—the accident being, he thought, attributable to the Motor Exhibition at Olympia. He said this experience was not uncommon, but fortunately one could fall back on the "Second to None" in reliability—gas.

Proposed Gas-Works Purchase at Abergele.—As was stated in the "JOURNAL" at the time, Abergele recently experienced the discomfort of having its gas supply cut off during some alterations at the works; and the Gas Company were subjected to a vote of censure at the hands of the Urban District Council. Since then, the Council have unanimously resolved to refer to a Committee the question as to whether the gas undertaking should be acquired, and whether compulsory powers should be sought, if necessary, to carry out the project. Mr. Judson, who moved the resolution, pointed out that Colwyn Bay had purchased the gas undertaking there and worked it successfully. He felt sure that if the Council did resolve to acquire the Abergele Gas-Works they would never regret it. He did not think the cost to the town would be much more than £70 per annum on a thirty years' loan. Another member, however, dissented from this estimate, placing the figure at more nearly £400 a year.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

Annual Report.

In the report on the working of the above-named Company in the twelve months ending the 30th of June last which will be presented at the annual meeting on the 10th prox., the Directors state at the Messina and Montargis stations the increase, both in the number of consumers and in the quantity of gas sold, was over 6 per cent. They express regret that, so far, the first-named town has not been able to raise the loan to which reference was made in the last report. During the year, the Union des Gaz obtained concessions for the lighting of the communes of Houilles, Franconville, and Mesnil-le-Roi, and renewed that of Croissy. It also contracted for the supply of electricity at the last-named place and also at La-Celle-Saint-Cloud. These two new communes adjoin Paris; and, in addition to those referred to last year they will be supplied from the Nanterre works, which are being enlarged to meet the increased demand for gas in this important centre. The private consumers of the Union des Gaz have increased by 14,791—making a total of 229,194—and the public lamps by 468. The quantity of gas sold shows an increase of about 8 per cent. over the year 1905-6. As was anticipated, the cost of coal was higher than in the previous year; but better prices were obtained for coke. The length of mains was increased by 73 miles—making a total of 1049 miles. The amount spent on capital account during the year was £112,011, inclusive of the cost of the land acquired for the new works at Milan. The Union des Gaz has maintained its dividend at the same rate as last year; and after providing for debenture interest and debenture redemption, adding £12,000 to the sinking fund, and £44 000 to its various reserves, the amount carried forward is increased to £15,176. The net available balance of the profit and loss account of the Continental Union Gas Company is £73,145, from which the Directors recommend the payment of a dividend for the year of 7 per cent. on the preference stock, less income-tax, and 6½ per cent. on the ordinary stock, free of income-tax, and the carrying forward of £7845 to the next accounts.

POWER-GAS SCHEME FOR EAST LONDON.

Project of the Coalite Company.

As briefly mentioned in our "Parliamentary Intelligence," the British Coalite Company, Limited, have given notice of their intention to apply to Parliament for authority to construct gas-works, &c., at Barking, and supply gas for power, heating, &c., in West and East Ham, Barking Town, and North Woolwich. The works are to be put up on the Company's land in the parish of Barking, and the Company propose to "manufacture, procure, store, distribute, sell, and supply" power gas, and "procure, convert, and store," within their area, and deal in and supply, materials and residual products, and manufacture, supply, or let on hire machinery and apparatus of any description for, or in connection with, the above-named objects or any of them. They wish to be empowered, within their area, to "purchase and dispose of lands, or interests or easements in or over lands, and to erect, maintain, manufacture, repair, work, use, produce, store, supply, sell, and let stations, storehouses, buildings, engines, machinery, vessels, producers, retorts, works, plant, stock, meters, fittings, and apparatus," and to "exercise such powers and do such work, and supply such materials as may be necessary or convenient in and for the production, storage, transmission, conveyance, measurement, distribution, and supply of power gas as aforesaid, or otherwise carrying on the undertaking of the Company as proposed to be authorized by the intended Act." Authority will, of course, be required to open streets and other thoroughfares, and lay down the necessary mains, including pipes for conveying water, and for this purpose to exercise the powers of the Gas and Water Works Clauses Acts, or some of them. In the Bill to be promoted, provision will be made for the inspection and testing of mains, pipes, and works, for the appointment and remuneration of gas inspectors and examiners, and for the supply, use, inspection, testing, and certifying of meters, fittings, and other apparatus.

The Company wish to be authorized to enter upon any houses, buildings, or lands supplied or proposed to be supplied with power gas for any purposes relating to such supply; and they will ask to have conferred upon them the same powers of laying down and maintaining mains, pipes, pillars, and other works in, and breaking up and dealing with, roads not dedicated to the public, as are or may be conferred by the Gas-Works Clauses Act, 1847, or the intended Act in respect of public roads. Authority will be sought to demand and recover rates rents, and charges, differential or otherwise, and with or without allowance of discounts or rebates, for the supply of power gas and any materials or residual products resulting from its manufacture; also for the sale or hire of engines, producers, machinery, meters, stoves, fittings, &c. Special provision is to be made with respect to the rights and obligations of the Company to afford a supply of power gas, and the terms and conditions on which, and the bodies and persons to whom, such supply will be afforded, and the exercise of all or any of the powers affecting streets and roads and the control and regulation of the operations of the Company, and, so far as necessary, to exempt the Company from the provisions of the Gas-Works Clauses Acts of 1847 and 1871, in regard to such matters or any of them.

The proposed Bill will empower the Company on the one hand, and any local authority or company authorized to supply or to use electricity, or any County Council or other local authority, body, or person on the other, to enter into and carry into effect contracts and arrangements for or with respect to the supply by the Company of power gas in bulk or otherwise, for the manufacture or generation of electricity or any other purpose, and the terms upon and the price at which such supply may be afforded, and from time to time to vary, suspend, or

rescind any such contracts or arrangements and make others in lieu thereof or in addition thereto; and also enable all parties to any such contracts or arrangements to apply their funds for the purposes thereof, and to raise additional money by rates or otherwise, and to sanction and confirm agreements already made, or which prior to the passing of the Act may be made, touching these matters or any of them.

The other provisions of the Bill will exempt meters, fittings, &c., from distress; authorize the Company to make bye-laws and regulations to prevent the waste or misuse of their gas; give power to their servants to inspect engines, fittings, meters, &c., with this object; and provide for the imposition and recovery of penalties for tampering or fraudulently interfering with these appliances or failing to comply with the bye-laws. The Company will incorporate with their Bill, with or without alteration or modification, and extend and apply to the purposes of the intended Act and to the Company, with or without exception or variation, all or such of the provisions of the Gas-Works Clauses Acts of 1847 and 1871 as may be thought expedient and applicable. It is proposed to exempt the Company from, or apply to them in a modified form, all or any of the provisions of these Acts, and especially, but not exclusively, of the following: "(1) The provisions of the Gas-Works Clauses Act, 1847, with respect to the amount of profit to be received by the undertakers when the gas-works are carried on for their benefit; and (2) provisions of the Gas-Works Clauses Act, 1871, with respect to a supply of gas to owners and occupiers of premises, supply of gas to local authorities, testing of gas, accounts, and penalties."

GAS v. ELECTRICITY AT NEWCASTLE.

The Lighting Committee of the Newcastle-on-Tyne Corporation recently decided to recommend that the lighting of a portion of Westgate Road, representing a distance of 1573 yards, should be carried out by electricity. At present, the part referred to is lighted by 49 No. 3 Kern, and three 10-feet self-intensifying gas-lamps, the annual cost of which is £128 4s.; the total power being equal to 3840 candles. To increase the lighting, 5-feet self-intensifying gas-lamps could be substituted for the No. 3 Kern burner lamps; and the annual cost would then be £171 18s., an increase of £43 14s. For the extra sum, the candle power would be increased from 3840 to 8850, and the lamps would be placed 35 yards apart. Electric arc lamps could be adopted at an annual inclusive cost of £9 each. Forty lamps, at 40 yards distance from each other, would then be required; and the annual cost would be £360, an increase of £231 16s. on the present cost, and £188 2s. on the suggested improvement with gas-lamps. The total power claimed for the enclosed arc lamps is equal to 20,000 candles, as against 8850 candles for the gas-lamps. Such an increase in the annual cost as the adoption of the electric arc lamps would entail is not provided for in the current estimates.

The recommendation of the Lighting Committee came up for confirmation by the Watch Commitee at their meeting last Friday, when there was a large attendance and a discussion in which almost every member took part. Mr. A. Appleby, the Vice-Chairman of the Watch Committee, moved an amendment that the road in question should be lighted by 5-feet self-intensifying gas-lamps. Upon a vote being taken, 8 voted for and 8 against the amendment. Three members declined to vote, as they were interested in the Gas Company. The Chairman (Alderman John Goolden) was one of these three members; and he intimated that as he was a shareholder of the Gas Company he must decline to give his casting-vote. The amendment was therefore not carried. Another amendment was then moved by Mr. Millican, to the effect that the matter should be referred back to the Lighting Committee, with instructions to consider whether the number of electric lamps in their proposal could be reduced consistently with efficiency: and this was agreed to.

Writing on the subject to the "Newcastle Daily Chronicle," Mr. G. G. Elliott says: "The Watch Committee estimates have risen in six years from, roughly speaking, £17,000 to £29,000—nearly double. The North Road cost when lighted by gas less than £200 a year; the electric light is costing nearly £700, or £14 a week. Jesmond Road used to cost £150; it now costs £500, or £10 a week. Osborne Road used to cost £130; it now also costs £500, or £10 a week. Gallowgate, £73, now costs for electric light £230. What do the ratepayers think of extravagance of this character? Can it be justified on any grounds whatever? Facts like these ought to have made any ordinary body of men pause, and more especially the members of the Lighting Committee of the Council. But such is not the case."

THE LONDON SMOKE PROBLEM.

Under the auspices of the Incorporated Institute of Hygiene, a conference on "London Smoke and its Effect on Health" was held on Monday last week, at the rooms of the Institute. Sir William Richmond, R.A., the President of the Coal Smoke Abatement Society, who occupied the chair, said his own experience, and probably that of others present, went to show that smoke was bad for the nervous system, the bronchial tubes, the eyes, and the nose; but as he was not a doctor he preferred to speak of it so far as it affected works of art and decoration generally. His experience was that fresco painting could be safely pursued in the country, but not in London, owing in the latter case to the presence of evil fumes in the atmosphere. As showing the heaviness of a smoke-fog, he mentioned that on the occasion of such a fog about fourteen years ago, the glass at Kew Gardens, about three-quarters of a square mile in area, could not be washed, and had to be scraped, the weight of the deposit being no less than three tons. The effect on plant life, too, was very serious. In these circumstances, they could not be too energetic or unite together in too earnest an appeal for relief from such a damaging nuisance. Dr. Des Vœux moved—"That the coal smoke in the atmosphere is injurious to health and lowering to vitality, and that every possible means should be adopted to find a remedy." He described the chemical composition of smoke, and remarked that the deleterious constituents were the sulphurous compounds, which were very irritating to the lungs. Various speakers having expressed their opinions, the motion was carried.

ORIENTAL GAS COMPANY, LIMITED.

Strengthening the Position of the Concern out of Revenue.

The Ordinary General Meeting of the Company was held on Wednesday last, at the London Offices, Finsbury House, E.C.—Mr. R. Hesketh Jones in the chair.

The Secretary (Mr. H. J. Luff) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

The Chairman, in moving their adoption, said the chairman at a meeting of the proprietors of a gas company had seldom the pleasure which he had that day in presenting so satisfactory a report and balance-sheet. He thought they needed no comment from him to recommend their adoption; but the shareholders would naturally expect him to say something in connection with the public lighting of Calcutta. On June 30 there were altogether about 9400 lamps lighted by gas; and since then additional orders had been received which had been, or were being, executed. The proprietors were no doubt aware that in the "Times" and other papers last May, there appeared an advertisement inviting tenders for the public lighting of Calcutta by gas, electricity, or other means. Tenders were to be delivered by Jan. 2 next; and the contract was to commence as from May 1, 1911. The Board (in conjunction with their Manager in Calcutta) had given, and continued to give, close attention to this subject, with a view to retaining the public lighting by gas, which in very many large cities and towns had proved itself to be far superior to electricity for the purpose—in fact, one might say that universally gas for public lighting was found to be not only better, but cheaper than electricity, light for light. He might mention that, in the suburban parts of Calcutta, there were some roads and streets now lighted by about 2400 oil-lamps. These would in all probability be superseded by a superior mode of lighting, which would involve a large expenditure, as there would be some 75 miles of mains and the necessary lanterns, &c., to provide. However, the Oriental Gas Company would cordially co-operate with the authorities in their endeavours to light the city and suburbs in the most efficient way, and that way was, undoubtedly, with incandescent gas-lamps. The proprietors would, he was quite sure, excuse any further allusion to the matter, beyond the assurance that it was receiving the Board's most serious and careful consideration. He hoped that, at the next meeting of the Company, it would be the pleasure of the Chairman to announce that the public lighting contract had been renewed upon terms satisfactory alike to the Company and to the Corporation; and when the improved lighting scheme was carried out it would, he was certain, be appreciated by the general public. With the permission of the shareholders, he would read some interesting extracts from the General Manager's annual report, which he might preface by stating that, during the past year, about 8 miles of additional mains had been laid, and that altogether the mains now approached 300 miles in extent. The General Manager said: "We have had a busy year both on the works at Sealdah and Howrah, and on the districts. We have had great opportunities of showing in Calcutta what gas can do; and I am pleased to report that the Company were awarded a gold medal at the Indian Industrial and Agricultural Exhibition held in December, 1906, for the cheapest and best light of its kind. We also made a good exhibition of high-pressure and other forms of gas lighting at Lady Minto's charitable fête in January, 1907, for which we received her Excellency's personal thanks. The public lighting, as well as that of private consumers, is greatly improved; and we are showing to the citizens the newer styles of lanterns as against the older patterns, and favourable opinions are being received. The sanction of the Lieutenant-Governor of Bengal has been received for a large extension of gas-lighting within the districts of Cossipore-Chitpore Municipality. In addition to orders for public lamps, we have applications from private consumers within this large increase of our area of supply. The Manicktollah Municipality have doubled their number of public lamps, and this also adds to our district east of the Sealdah Gas-Works. The addition of another gasholder to our Sealdah works was satisfactorily completed by Messrs. Clayton, Sons, and Co., of Leeds, during the year; and it marks another eventful stage in our history. The excavation of the tank as well as the concrete foundations were done by our own workmen, and have been found correct and sound. The whole of the riveting and erecting was also done by native labour, under European supervision. With the aid of this increased storage of 1 million cubic feet, we have been enabled to maintain a day supply of gas, and the prosperity of the Company is undoubtedly enhanced by its being able to supply the manifold needs for gas for motive purposes, for cooking, for heating, and for industrial requirements. We are now making arrangements for supplying gas stoves, geysers, and appliances for which gas is necessary, and are notifying the public of the fact of our being able to supply all that is required of us. At an impressive public ceremony, the new gasholder was named the 'Robert Hesketh Jones' by the Chairman of the Corporation of Calcutta, the Hon Mr. Allen, I.C.S., who wished the Company all luck and prosperity. Many visitors were present, and an opportunity of witnessing the process of gas manufacture, &c., as well as the more intricate form of mantle making, &c., was given. Probably this is the first time so pleasant a function has taken place at our works; and I augur the best results from this latest advance in our endeavours to place ourselves at the service of the residents of Calcutta. The Master of the Mint of Calcutta has arranged for the annealing of the coins by gas heating, to save discoloration of the newly-manufactured coinage, and a great saving is confidently expected by this addition to our business. We have made great progress in improving the condition of our works and mains. The Sealdah works improvements are nearly finished, and next year we hope to make considerable progress with our Howrah works. All departments have been extended during the year, and additions made to our staff and workmen. We have been free from labour troubles, and I believe we have a loyal set of workers. I have received assistance from all sections of the staff and workmen; and I gratefully acknowledge the ready co-operation of the London Secretary and staff in carrying out the wishes of

the Chairman and Directors in their efforts to promote the interests of the Company."

Mr. R. MILLER seconded the motion.

The CHAIRMAN, replying to an inquiry, said the new gasholder had not been entirely paid for. But all that was due had been paid. A portion would have to be paid in the current year, for which provision had practically been made.

Mr. CAVE ORME remarked that, for some five or six years past, the Chairman had had the gratification of reporting an increase in the revenue. The increase in five years had amounted to £17,500. It would naturally follow from this that the shareholders would expect to see a greater profit. Upon analyzing the accounts, however, he saw that this was not so. The profit made had actually been less, and continued to be less on the whole during that period. He did not, of course, wish to embarrass the Directors in any way; but he should like to have some explanation as to how this was, and how long it was likely to continue. He found, on looking at the accounts, that the wear and tear on the works had increased regularly every year by considerable sums—amounting to thousands of pounds. In 1902 the item was only £3000, but it amounted last year to £8000 or £9000; and in this year's accounts, with the expense of the gasholder, it was about £16,000. The item of "mains, meters, services, and fittings," which in the year 1902 only amounted to about £6000, now reached about £12,000; and in last year's accounts, about £13,000. The net result was that, although the business continued to increase very materially, the net profits did not show an increase. One of the greatest tests of the prosperity of a business was its power to divide profits. He was not for a moment suggesting that the Board should have divided more profits during any part of the period in question. He was only seeking a reason why it was they had not been able to divide more profits. He should also like to know whether the present cost of earning their money was likely to continue, or whether it was now going to diminish, and whether a portion of the increase on the gross revenue was soon to turn to something in the nature of increased dividend.

Mr. LOUIS PENNY asked whether Mr. Cave Orme had not overlooked the large increase in the reserve fund, and the point as to the whole cost of the large new holder being paid for out of revenue and not out of capital. This would account for much of the profits not shown.

Mr. CAVE ORME remarked that he had looked at these figures; and it appeared that the increase of revenue had totalled in the past few years to some £24,000; but the addition that had been made to the reserve fund and the cost of the holder did not anything like account for the whole of the money.

The CHAIRMAN replied that, year by year, in the last five years an enormous amount of money had been spent in putting the works in proper condition and in enlarging them. The whole of this expense had been paid out of profits, as well as the cost of converting the public lamps to the incandescent gas system. At the works, they had erected the large gasholder and built a new retort-house; and nothing whatever had been added to the capital account. He thought this was a most healthy way of treating the finances of any company. Whenever shareholders in gas companies looked on the wear and tear account, and saw it amounted to a substantial sum, they might be sure that a large expenditure had been incurred in improving the property; and he could say that the property of the Oriental Gas Company was worth to-day far more than it was five years ago. The Company was now a sound, solid, and good concern; and for anyone to pick a hole in its condition would be a most difficult task. With reference to future expenditure. In the current year it would be heavy, because they had not paid the whole cost of the holder; it was being spread practically over three years. After that was paid off, and they were fortunate enough to get a renewal of their public lighting contract, the Directors would be in a better position to talk over the matter as to whether or not there should be an increase of dividend. In the meantime, the shareholders must have full confidence in the Board—not only in preserving the present excellent condition of the Company, but also in making it still firmer as an investment.

Mr. CAVE ORME said the explanation was perfectly satisfactory. He had merely thought that some explanation was called for upon the report as to the increase in the gross revenue.

The motion was unanimously carried.

Moved by Mr. H. D. ELLIS, and seconded by Mr. W. WILLIAMS, a dividend at the rate of 8 per cent. per annum for the year (less the interim payment of 3½ per cent.) was declared, free of income-tax.

On the proposition of Mr. A. T. EASTMAN, seconded by Mr. MILLER, the retiring Directors (Messrs. Ellis and Williams) were re-elected.

On the motion of Captain DAVID PETERS, seconded by Mr. H. A. WAKEMAN-NEWPORT, the Auditors (Messrs. Savage and Seel) were reappointed.

The cordial thanks of the shareholders were bestowed on the Chairman and Directors for their services, on the motion of Mr. CAVE ORME, seconded by Mr. PENNY.

The CHAIRMAN, having made acknowledgment on behalf of himself and his colleagues, moved that the thanks of the meeting be conveyed to the Company's Manager in Calcutta (Mr. J. C. Watson), the Assistant Manager, the Secretary, and the staff generally, both in India and London. He (the Chairman) thought it needed no remarks from him to point out to the shareholders that they had in Mr. Watson an excellent representative in Calcutta. He was most zealous, trustworthy, and in every respect an efficient officer. In their correspondence, there was nothing in the shape of friction; and Mr. Watson always promptly submitted to the Board his views, and asked for instructions. Mr. Luff, their Secretary, was on the eve of completing his fifteenth year in the service of the Company. He was also most attentive; and the same could be said of the whole staff.

Mr. ELLIS, in seconding the motion, said as to Mr. Luff he could not say before him what he might otherwise do; but as to Mr. Watson, not only was he a capable man, but he was a very tactful and judicious man. They might have a man who was a perfect genius in charge of their works; but if he was without tact, and rubbed people the wrong way, he would do harm instead of good. Mr. Watson possessed the qualities of tact and diplomacy; and therefore the Company had in him a valuable man.

NEW GAS-WORKS FOR AMMANFORD.

Opening Ceremony.

The gas-works which have been constructed by the Amman Valley Gaslight and Coke Company for the lighting of Ammanford—a mining and tinplate centre in East Carmarthenshire—were formally opened last Saturday; the ceremony being performed by Mr. Abel Thomas, K.C., M.P. The works, which were put up by the Gas Supplies and Construction Company, stand upon an acre of ground leased by the Company. They consist of a retort-house 65 feet long, 60 feet wide, and 30 feet high, built of brick and stone, with slated roof, and fitted with louvre ventilators—erected with the view of eventually installing stoking machinery. The works are connected with the Great Western Railway Company's system by sidings, so that coal will be delivered on to the works. There are at present four beds of retorts on the regenerative principle; but there is room for at least four more. The exhauster will deal with 6000 cubic feet of gas per hour, and it will be driven by a Crossley gas-engine. The station meter and the governors have been placed in a brick and slate building; and the purifiers are in a structure with open sides and tiled roof. The scrubber is on the rotary principle. The condenser was furnished by the Gas Supplies and Construction Company; the whole of the ironwork for the regenerator furnaces by Drakes Limited; and the girders for the cellar work by Messrs. Measures Bros., of London. The gasholder, which is some 45 feet in diameter, and stands in a steel tank 20 feet high, was supplied by Messrs. J. Firth Blakeley and Co., of Dewsbury. The town has been piped with 6-inch cast-iron mains, so far as the principal thoroughfares are concerned; but in the streets 3-inch pipes have been laid. Up to Saturday last, more than 100 installations had been put on; and it is stated that the Company have 2000 signed orders on their books.

At the opening of the works, at which Mr. E. Eaton and Mr. John Maclean, Directors of the Company, with the Secretary (Mr. P. Davies), were present, Mr. Thomas expressed his pleasure that Ammanford had the blessing of a Gas Company, and said he had no doubt that in the almost immediate future the population of the Amman Valley would increase.

After the opening, luncheon was partaken of in the retort-house—Mr. Eaton presiding. Mr. Thomas proposed—"The Amman Valley Gas Company, Limited," which was responded to by the Chairman. The toast of "The Directors" was given by Mr. D. J. Davies, of Llanelly, and acknowledged by the Chairman and by Mr. Evans, the Chairman of the Whitland Gas Company. Mr. Maclean proposed "The Hon. Member for East Carmarthen," which was responded to by Mr. Thomas.

ELECTRICITY LOAN REFUSED.

Unprofitable Undertaking at Newport (Mon.).

An application to the Local Government Board was some time ago made by the Newport (Mon.) Corporation for sanction for a further loan for their electricity undertaking; and in due course an inquiry was held, when the financial side of the concern was subjected to the ordeal of a very thorough examination. The result has been disastrous; for the Board have informed the Corporation that they "will not be in a position further to consider the application so far as it relates to the borrowing of the sums of £17,500 for prospective expenditure on mains and services, £1000 for prospective meters, and £7978 for new works at the Llanarth Street Power Station, until the Board have been definitely informed of the steps the Town Council intend to take with a view of wiping off the deficit on the undertaking."

The deficiency referred to is a sum of £2864, the immediate liquidation of which, it is said, would need a rate of 2¼d. in the pound. The position was an unpleasant one to face; but the Chairman of the Electricity Committee (Mr. F. Phillips) did face it, when the matter came before the Council for consideration, by moving that the amount be paid out of the general district fund. At the same time, he called the attention of the Council to the fact that they commenced these negotiations with the Local Government Board last October twelve months, and that they intended to take steps to get an interview with the Board, so as to place their grievance as a Council before them in regard to the time that they took to answer letters, and other matters. Before the motion was adopted, there was considerable discussion; and in answer to various questions, the Town Clerk said the present deficiency represented the balance of profit and loss for a period of five years. The Board were taking away the discretion of the Committee by proposing to penalize them, and force them into doing a certain thing by saying: "Unless you do it, we shall not sanction this further capital expenditure." He did not think the Council would prejudice themselves by the action proposed by the Committee.

Mr. Evans advocated paying the deficiency out of the general district rate, believing that by so doing they were only doing what was right and what was law; while the Mayor remarked that whether the Council had a loan or not, the Board had a perfect right to call upon them to pay off the deficiency. Mr. Wilkinson here exclaimed: "I prognosticated this 3 years ago. I prophesied that your wasteful extravagance, and the rate at which you were travelling, would bring this town to the brink of ruin. Now, this is the price the ratepayers have to pay for politics, progress, and shortsightedness on the part of their representatives here. So far as any increase in the rates is concerned, I shall strongly oppose it." Mr. Robjent made a long speech, in the course of which he said he was confident the Board were in the right. It was proper that they should have taken the strong line they had done, unless the Council could satisfy them that they had a reasonable prospect of wiping off the debit balance. Mr. Wright hoped the Committee would go thoroughly into the question of their lighting scheme. If they did, he believed they would find that they had been misled by the facts introduced into the Council by the management. The Mayor pointed out, however, that since 1901 it had not been all

loss to the Committee. Only £500 had accumulated prior to last year; so that practically the whole of the loss was made in that year. They must remember the price of small coal had gone up from 7s. to 10s. per ton during the past year.

In replying to the discussion, Mr. Phillips said the Committee were endeavouring to carry on the undertaking as well as they could. The resolution only committed the Council to deal with the deficiency; and they had no alternative, because the Local Government Board had plainly stated that they would not sanction the loan until the Council had agreed to deal with the deficiency. Unless the Board adopted a better policy, they would have some difficulty in getting members to sit on the Committee; and the only thing to do then would be to sell the concern to a company to carry it on according to their own lines.

METROPOLIS WATER SUPPLY.

Important Report to the Metropolitan Water Board.

The Works and Stores Committee of the Metropolitan Water Board have prepared an important report on the water supply of the Metropolis. It is the result of many months' consideration of the subject, aided by some valuable reports by the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.); and it has been submitted with a view to obtaining instructions for the preparation of a definite scheme to provide for the future.

The Committee begin by reviewing the present position; and they show by tabulated statistics that the average daily supply of water to London has gone up from 143·8 million gallons in 1881 to 225 millions in 1906-7, while the estimated population has increased from 4,331,619 to 6,851,045—the consumption being 33·2 gallons per head per day in the first-named year and 32·84 gallons in the second. Of the 225 million gallons, 128·8 millions, or more than 57 per cent., were drawn from the Thames. These figures show that the demands made upon the Board increase daily; and the question before the Committee was how far they can be met by drawing further upon existing sources. Taking the Thames first, the total daily authorized abstraction by the Board is given as 228½ million gallons; but the Committee point out that it is impossible for the Board to exercise their full statutory rights in this respect until sufficient storage reservoirs have been constructed. The question of obtaining additional supplies from the Thames resolves itself, therefore, largely into one of increasing the number of these reservoirs. With regard to the other sources of supply, the Chief Engineer estimates that in the future the following maximum quantities will be available:—

	Million Gallons.
River Lea and storage	45½
Wells in the New River and eastern districts	40
Wells in the Kent district	27½
Wells in the southern district	7
Total	120

These figures are practically identical with those adopted by the Balfour Commission.

The Committee next turn their attention to future requirements. Reckoning the average daily consumption at 35 gallons per head, which the Balfour Commission thought should be regarded as the right quantity, and allowing for the increase in population, the Chief Engineer estimates that in the year 1916, out of a total of 281 million gallons, 106·5 millions a day will be obtainable from all the present sources other than the Thames, and that this figure can be subsequently increased to only 120 millions. On the other hand, it is anticipated that the supplies from the Thames may be increased from 174·5 million gallons in 1916 to 450 million gallons in 1961—an increase of 275·5 million gallons a day. In other words, of the existing sources of supply, the Thames alone is capable of considerable expansion. The question then is: How can the supplies from the Thames be increased? This is the matter next considered by the Committee. They had before them a report by Mr. Bryan on this subject; and he stated that a total gross storage of 54,059 million gallons (the quantity estimated for 1960) would give a daily average supply of 450 million gallons from the Thames; and the Committee think this quantity is "the limit which could be economically derived from this source." According to Mr. Bryan, to increase the supply from the river from 400 to 450 million gallons a day, it would be necessary to augment the gross storage by 9197 million gallons; whereas to increase the supply by another 50 million gallons a day—viz., from 450 to 500 million gallons—additional storage to the extent of no less than 44,630 million gallons, involving a capital expenditure of between £13,000,000 and £14,000,000, would be needed. The works at present in existence and those authorized will suffice up to about the middle of the year 1917. As additions should be commenced not later than 1912, and parliamentary powers sought in the session of 1910, the Committee point out that the problem before the Board does not admit of any unnecessary delay in arriving at a conclusion.

The Committee next consider schemes for the future. A great number of proposals have been submitted to Royal Commissions with the view of giving an increased supply of water to London; but the Committee's investigations, and the Board's experience up to the present time, emphatically support the conclusions of the two most recent Commissions—viz., that there is no reason to doubt that the Thames will for many years to come provide a supply of pure water for the consumers of the Metropolis. The Committee think too much emphasis cannot be laid on the fact that London is peculiarly fortunate in the possession of what is undoubtedly "an exceptionally favourable source of supply" in the Thames; and they cannot for a moment suppose that the natural advantages which the Metropolis thus possesses will be ever abandoned. Not only is it reasonable to anticipate that largely increased quantities of water will, as the Committee show, be available from this source, but the storage which must be provided to obtain these additional quantities will do much to still further improve the quality of the water.

From the facts and considerations placed before the Board, the Committee are confident that they correctly anticipate the Board's wishes in thinking that they will desire to give them instructions to prepare and submit for future discussion, at as early a date as practicable, a definite scheme for providing further storage in the Thames Valley. They think it would be out of place at this stage to indicate what possible forms that scheme might take; but they feel it is only right, before proceeding further with the matter, to obtain an expression of opinion by the Board on the principles and policy surrounding the whole question. With this object, therefore, they decided to ask the Board to discuss, and if they thought fit to adopt, the resolutions given below.

Before concluding their report, the Committee invite the attention of the Board to one aspect of the present problem which they regard as of great importance—viz., the desirability of acquiring, for the future needs of London, a supplemental gathering-ground for use when the existing sources are exhausted. This question was foreshadowed by the Llandaff Commission, who stated that they "would be glad if it were possible now to secure a watershed to be used hereafter if London should require it." The Committee think it is most important to bear in mind the fact that, in making this observation, the Commission had not inquired into the date by which it was reasonable to anticipate that the Thames would be practically exhausted as a source of supply for London. If the population which the Board may be called upon to serve continues to increase at the rates which have been assumed—and in the Committee's opinion, there is no evidence to justify any assumption to the contrary—they think "it will, practically speaking, be impossible to derive from this source any additional quantities of water to supply the wants of the population subsequent to the year 1960." In other words, London is face to face with the possibility that fifty years hence its present sources of supply will be capable of no further expansion. In their view, therefore, having regard to the vital importance of securing the Metropolis against anything approaching a dearth of water, and to the enormous interests at stake, they say it is essential that "earnest consideration should be given to the practicability of acquiring some supplemental gathering-ground which would be available in case of need after the exhaustion of the present sources."

The Committee call the attention of the Board to the fact that scarcely a year passes without some authority in the country promoting legislation with a view to acquiring a watershed for obtaining a supply, it may be, for use miles distant; and if nothing is done on behalf of London, it may result in all suitable areas being allotted to other authorities—a result which the Committee consider it is not too much to describe as a possibility of extreme gravity. The Committee anticipate the remark that the year 1960 is so remote that it is unreasonable to contemplate at the present time the steps which may be taken in order to provide for the supply at that date; but there are two considerations which they venture to think would modify any such conclusion: (1) That the construction of works to bring water to London from a distant source would be a task of great magnitude, occupying a considerable number of years—it might be twenty; and (2) the fact, to which they have already alluded, that there is a limit beyond which the existing sources are incapable of expansion, and that this limit is, after all, within measurable distance. Under these circumstances, they invite the earnest consideration of the Board to the second resolution which they submit. They add that, in their opinion, it would be desirable to invite the observations of the constituent authorities to their proposals at the earliest moment, and they have therefore provided for this in their recommendations.

The following are the resolutions referred to:

(*a*) That in the opinion of the Board it is desirable to seek parliamentary powers enabling them to provide additional supplies from the Thames for as long a period as is economically practicable.

(*b*) That in the opinion of the Board it is desirable that in any proposition which may be put before Parliament dealing with the Board's future requirements, powers should also be sought to acquire an auxiliary gathering-ground for use after increased supplies from the Thames are no longer economically available.

(*c*) That it be an instruction to the Works and Stores Committee to prepare and submit to the Board as early as practicable a scheme to give effect to the foregoing resolutions.

(*d*) That the estimate of £1000 to be submitted by the Finance Committee be approved, and that the Works and Stores Committee be authorized to incur expenditure not exceeding that amount in connection with the retention of experts to report upon the scheme for future supplies to be submitted to the Board, and with such other purposes as may be necessary in connection therewith.

(*e*) That a copy of the report of the Works and Stores Committee and of the resolution passed by the Board thereon be forwarded to each of the constituent authorities, inviting their observations upon the proposals contained therein.

The report above referred to came before the Board at their meeting on Friday last. It was presented by the Chairman of the Committee (Mr. E. B. Barnard, M.P.), who said they were fully alive to the importance of the question before them, and they were not approaching it in a hasty manner, for they had been engaged for two or three years in looking into the subject. What they were now proposing was not prompted by a dictatorial or presumptuous spirit. They were not in the old position of persons who were proposing something to compete with the Water Companies. They had endeavoured to outline a scheme, and they now asked the Board whether or not they wished them to elaborate it and bring it forward as a concrete proposal. The Committee had carried out independent investigations, and the result of the knowledge they had gained substantiated the general conclusions set out in the reports of the Royal Commissions presided over by Lord Balfour of Burleigh in 1892 and Lord Llandaff in 1897. He then drew attention to the existing supply, and pointed out that London water was gradually becoming better. There was efficient filtration; and the storage reservoirs were, practically speaking, meeting the present conditions. The real question before them was that the Committee were proposing to provide for the next fifty years; and as to the consumption of water per head per day, they had thought it best to accept the figure of the Royal Commissions—viz., 35 gallons. With regard to the population, they had calculated, more or less on the lines of the reports of the Commissions, that in 1961 they would require to provide for

16 million people, for whom 550 million gallons of water per day would be needed. Their position was, therefore, this—that they would want to obtain an additional daily supply of 265·5 million gallons. The Committee proposed to seek powers to acquire additional supplies from the Thames. They hoped to go farther up the river. In doing so they would obtain a better quality of water, and make it more safe than it was to-day; and they would also assist in arresting floods which might occur. They did not propose to carry out any great undertaking at once, but to work by degrees, and to construct reservoirs as they were called for. The Board's income was increasing, and he believed it would meet their requirements as they came. The speaker then referred to the desirability of acquiring a supplemental gathering-ground for use when the existing sources are exhausted; and, in conclusion, said the Committee thought that in the event of the Board deciding to go forward with the matter, and when they had formulated the scheme, it would only be right and proper to obtain some expert advice. If the resolutions appended to the report were passed, the proper thing for them to do would be to ask the constituent authorities if they had any remarks to make upon the general principles. The Committee had done their best to bring before London a scheme which would tend towards its benefit for many years to come.

After a short discussion, the report was received, and the matter adjourned for a fortnight.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Leith Town Council on Tuesday, Bailie Cochrane asked what the representatives of the Council on the Gas Commission thought of the system of the Commission in encroaching on the field of private traders. Bailie Pennell replied that the position which he thought the Leith representatives had taken up was that they wished to see an improvement in domestic lighting. He did not think the Gas Commission would continue to have their show-rooms throughout the town if incandescent gas lighting were taken up generally. He believed the result of considerable agitation had been that there was now something like 70 per cent. of the private lighting in Edinburgh done by incandescent burners, which had made huge strides since a motion was discussed by the Commission—he thought on his own initiative—that there should be brought before the consumers, by all possible means, the desirability of using the most improved mantles. There was an extensive inquiry; and he did not know that the private trader scored in it. It was not shown that the private trader was putting himself about much for such a very small department of his business as that of mantles. He took it that this movement on the part of the Gas Commission was more or less temporary, and that, as the public were sufficiently educated as to how they could, at less cost, obtain the best lighting, there might be no longer necessity for the Commissioners acting as they were doing. What they were doing was simply by way of advertisement and education. Bailie Cochrane asked if Bailie Pennell was aware that the Gas Commission not only sold incandescent mantles, but sold gas stoves and heaters, and sent men to fit them up, with pipes. Bailie Bryson, who is Convener of the Works Committee of the Gas Commission, said this was quite true; but he might explain that the Commission did no work without a clear profit of over 20 per cent., and, further, that they kept the show-rooms for the purpose of exhibiting gas-stoves and other appliances for the burning of gas. Bailie Cochrane thought that this public Corporation were trespassing too far on the private trader. Provost Mackie remarked that if the Gas Commission had not taken up the attitude they had, they would have been in a worse position than they were at the present moment. They were obliged to advertise, as the tradesmen would not take the trouble to do so. He was not in favour of trading by the Gas Commission, if it could be avoided.

Last week, in the Kilmarnock Town Council, the Gas Committee reported that their attention had been called to a statement said to have been made by Mr. Thomas Smith, a member of the Committee, to the effect that a large waste of gas had been caused by the neglect or incompetency of an official at the new gas-works at Riverside. The Committee had made inquiry into the subject; and they submitted a written statement which had just been received from Messrs. Fairweather, the Gas Managers, in which it was stated that the incident took place on Dec. 10, 1906. The quantity of gas lost, as shown by their books, amounted to 20,900 cubic feet; but from this there must be deducted at least 5000 cubic feet as the quantity lost every time a purifier was changed, which reduced the actual loss to 15,900 cubic feet, of the value of £2. In the Council the feeling was strongly expressed that the whole reference to the incident should be deleted from the minutes; and this course, upon the appeal of Provost Gemmill, was adopted.

There has been a good deal of agitation in Aberdeen of late, both at electioneering meetings and in the newspapers, over the circumstance that both the Gas and Electricity Departments of the Corporation have been under the charge of one Committee of the Council. The agitation reached its climax on Monday, when there was a long discussion in the Town Council, the result of which was that a separate Committee has been appointed for each department, with separate Conveners. The next business was the appointment of an Electricity Committee, which was effected without remark; but on the question of the convenership there was a great deal of discussion. Mr. Gray and Mr. Kemp were both nominated; and the vote went in favour of Mr. Gray. A Gas Committee were then appointed, with Mr. Stewart as Convener.

In the Falkirk Town Council this week, the Manager—Mr. W. Wilson—reported that he was experiencing some difficulty in the handling of coke, owing to the Railway Company withholding empty waggons; and he suggested that a temporary wooden gantry, with a narrow-gauge railway thereon, with side-tipping trucks, to enable the coke to be transferred from the shoot of the coke conveyor to the yard, should be constructed. The Council approved of the suggestion.

20, Fennel Street

(off Corporation Street),

MANCHESTER.

These are the Show-Room addresses of

DAVIS the Gas Stove People

where they invite inspection of their "DIAMOND" Series of Gas Fires. These are up-to-date in design—all parts are Loose and Strictly Interchangeable—the "DAVIS" Gas and Air Adjuster is ahead of all others. "DIAMOND" Fires are ideal for hiring purposes.

59, Queen Victoria St.,

LONDON, E.C.

The fourth annual concert in aid of the funds of the Sick Benefit Society of the Edinburgh and Leith Corporations Gas Commissioners' employees was held in the Synod Hall in Edinburgh on the evening of Thursday of this week. Mr. W. R. Herring, the Engineer, was in the chair. In the course of an address, he said that the Society, which was originated in 1904, was in a flourishing condition. The total sick allowance paid during that period had been £425, which was distributed among 269 of their men. A balance of £72 had been carried forward. For the small sum of 3d. per week, a member was entitled to considerable benefits during the period of sickness. He was surprised that more of the men were not members of the Society, which was managed by themselves. Out of nearly 700 employees, only 307 had thought fit to become members. As the result of inquiry, he had found that in the majority of cases there was a hesitancy among the young men to join. He did not see why this should be, more especially when they recollected that four out of every five of the accidents which occurred among the employees happened to young men.

The Larkhall Gas Company, Limited, have just completed a scheme of reconstruction of their works which they began a year or two ago. It has been already noted that a new gasholder with cast-iron tank has been erected, the holder being of 70,000 cubic feet capacity, and prepared for telescoping; and that a new retort-house has been built, containing a double retort-bench, on the regenerative principle, and of such capacity as to give room for probable future requirements. The last section of the works has been dealt with during the current year. In this part there have been erected a new purifier-house and lime-store, with two new purifiers, the two existing purifiers having been removed and re-erected so as to form a group of four, worked by a Weck centre-valve; a new condenser added to the existing condensers, and arranged to work in sections; a new exhauster-house, with a new exhauster, to work in conjunction with an existing one; and a new scrubber-washer, driven by its own steam-engine. Ample storage for tar and liquor, with space reserved for their treatment, has been provided. The most has been made of the available ground in arranging these extensions, with the result that open yard space and facilities for handling coal and coke have been increased and improved. All the extensions and renewals have been designed and carried through by Messrs. A. Gillespie and Son, consulting engineers, of Glasgow.

Theft from prepayment meters is a crime which continues to flourish—a fact which is due, I fear, to the inadequate punishments that are frequently imposed upon the wrongdoers. For instance, in the Sheriff Court in Dundee last Monday, a labourer was brought up on a charge of having broken open a prepayment meter in a house in Hunter Street, and stolen 2s. 10d. The Sheriff inflicted a fine of 10s., with the alternative of seven days' imprisonment. Magistrates might consider that prepayment meters have been introduced as a means of assisting the poorer classes of the community to live in greater comfort; and that, therefore, to tamper with them is more heinous than even pocket-picking. Besides, continued peculation from them is very apt to lead bodies who supply gas to be chary of extending or continuing the benefits which the meters confer.

The first ordinary general meeting of the Turriff Gas Company, Limited, was held on Monday. Provost Hutcheon, who presided, said that since they last met they had been deprived of the able and valuable services of Mr. James Duncan, one of the original promoters of the Company; and he moved that they insert in the minutes an expression of their deep regret at the death of their late partner. This was agreed to. The Directors reported a profit of £186, and recommended a dividend of 5 per cent., free of income-tax; a balance of £104 being carried forward. They also advised that, notwithstanding the large rise in the price of coal, the price of gas should be retained at 5s. 3d. per 1000 cubic feet for cooking and heating, and 6s. 3d. for lighting.

Bailie Hamilton has been re-elected Convener of the Gas Committee of the Hamilton Town Council. Provost Glover has been re-elected Convener of the Gas Committee of the Dumfries Corporation, with Bailie Thomson as Sub-Convener. Mr. Geo. Young has been appointed Convener of the Gas Committee of the Corporation of Inverness; and Bailie Scott has been re-elected to the convenership by the Town Council of Denny. In Grangemouth, the Town Council have re-elected Bailie Main Convener of the Gas Committee.

The Corporation of Falkirk have given notice that they are to apply for a Provisional Order to empower them to borrow an additional sum of £75,000 for water purposes. The capital is required for the completion of works already authorized, and for the construction of new works; also for the completion of works already authorized by the Act of 1900, an extension of time is to be asked. These works consist of a new reservoir on the Earl's Burn, filters in connection with the water system in the parish of Denny, and a new line of main pipes from there to High Street, Falkirk. The new works contemplated are new main pipes in the Larbert and Stenhousemuir district. Most of the new capital which is to be asked for is for these works; but the Trustees propose to take powers to raise (included in the £75,000) £10,000 or £12,000 to meet the requirements of the water system during the next ten years or so.

Last Wednesday's Fog.—A representative of "The Tribune" ascertained from Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, that last Wednesday's darkness in London meant almost doubling the Company's output of gas for the 24 hours over the district affected. He was unable to give figures; but he stated that the Company were so used to dealing with the sudden drain upon their resources caused by a fog that it had become a matter of ordinary winter routine. When all their retorts were at work they were quite prepared to encounter any number of consecutive days of fog, and there was no fear of a breakdown in supply. At the South Metropolitan Company it was stated that the meter figures had been tabulated from 6 a.m. on Wednesday morning up to noon. The worst of the fog came after noon; but the figures for the six hours mentioned, when compared with the output for the same hours of the previous day, showed an increase of 13·8 per cent., amounting to an extra consumption of about 1,300,000 cubic feet of gas.

CLARK'S PATENT
'SYPHON' STOVES
THE
STOVES FOR HIRE.
EASY TO FIX
EASY TO WORK.
ALWAYS RELIABLE.
CONSUMERS ALWAYS SATISFIED.
S. CLARK & CO.,
Compton Works, Canonbury Road,
LONDON, N.
Show-Rooms: 58, HOLBORN VIADUCT, E.C.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Nov.* 23.

The market has been extremely quiet all through the week, there being a complete dearth of direct orders. Although the large makes were sold in advance and are being shipped, and although at the end of October there was not at any point any accumulation of stock, demand has not been sufficient to absorb the smaller makes, and prices have further declined, except in Scotland, where large shipments are being made. The closing quotations are £11 17s. 6d. per ton f.o.b. Hull, £12 to £12 1s. 3d. per ton f.o.b. Liverpool, and £12 5s. per ton f.o.b. Leith. In the forward position, quotations are nominal, buyers being quite off, and no important business has transpired.

Nitrate of Soda.

The market has recovered somewhat from its recent depression, and a considerable cargo business has been done at improved prices. Spot prices are 11s. per cwt. for 95 per cent., and 11s. 1½d. for refined quality.

Tar Products. LONDON, *Nov.* 25.

There has been little alteration in the market for tar products during last week. Pitch is still very quiet, with little demand for prompt delivery. Continental buyers are holding off the market, in the hope of obtaining more reasonable offers. In London, the value is not over 23s. and 23s. 6d.; while on the east coast business has been done at 22s. to 22s. 6d. for prompt delivery. At Manchester and Liverpool, there has not been very much business doing. The value is probably from 21s. to 21s. 6d. at the former, and 22s. to 22s. 6d. at the latter port. Creosote remains in about the same position, and, for the moment, is quiet. In London, there is some quantity of outside makes offering for prompt delivery at low figures; but the principal makers are well sold, and appear disposed to look on for the present. Midland makers are well sold, and ask 2⅝d. to 3d. In the North, prices are easier; and the values not over 2⅝d., at makers' works. Benzol 90 per cent. is steady. There are offers for prompt delivery in London at 8¾d.; but makers will not consider anything under 9¼d. to 9½d. for forward delivery. Benzol 50-90's and toluol are still quiet, and there is practically no business doing. Solvent naphtha is easy. Makers in the North will accept 10d. prompt, and 10¼d. forward; while in London the value is 1s. to 1s. 1d., though London makers themselves are fairly well sold. Carbolic acid is steady; but there is not very much business doing. Continental consumers seem disinclined to purchase for forward delivery except at very low figures, and at present the prices offered by dealers are of greater interest to the makers, who in most cases are fairly well sold.

The average values during the week were: Tar, 14s. to 18s. *ex* works. Pitch, London, 23s. to 23s. 6d.; east coast, 22s. to 22s. 6d.; west coast, 21s. to 22s. Benzol, 90 per cent., 8¼d. to 8¾d., casks included; 50-90 per cent., 8½d. to 9d., casks included. Toluol, 9¼d. to 10d., casks included. Crude naphtha, 3⅞d. to 4d., naked; solvent naphtha, 10½d. to 1s. 0½d., casks included; heavy naphtha, 11½d. to 1s. 1d., casks included. Creosote, London, 2½d. to 2¾d., naked; North, 2⅝d. to 2¾d., naked. Heavy oils, 3⅛d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 7¾d. to 1s. 8d., casks included. Naphthalene, £6 10s. to £12 10s.; salts, 37s. 6d. to 42s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d., casks included.

Sulphate of Ammonia.

This article is steady, and prices are unaltered. For the moment, there is not much demand, though makers are still very firm in their ideas. The principal London Gas Companies quote £12 7s. 6d. to £12 10s., and report having realized the former price for prompt. Outside makes, however, are not fetching more than £11 17s. 6d. to £12 on Beckton terms. In Hull, the market is £12 to £12 2s. 6d.; and in Liverpool, £12 2s. 6d. to £12 3s. 9d. Leith makers are quoting £12 5s. to £12 6s. 3d. for prompt. For delivery to March they are well sold, and will only sell at good figures; but they appear inclined to do business for April-September if a fair margin is obtainable.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The general condition of the house trade is on the side of easier requirements. The export trade is also less pronounced; and, if anything, steam coal is not so much in request. The demand for burgy and slack, however, remains firm. All coal of this class brought to the surface is sent off as fast as it is produced. The small amount of coal that has been stocked during the last few months is being encroached upon. There is more inquiry for gas coal and cannel, but chiefly in connection with existing contracts. Enlarged deliveries are required. Coalowners make no reductions in prices. The terms at the pit's mouth, fixed in September, still hold sway. An important matter to colliery proprietors is the settlement of the difficulty relative to the increased railway rates for coal which have been agitated for during the last five months. The Board of Trade have intervened, and both parties have agreed to submit their respective cases to a Committee, with power, if possible, to settle the question. Hopes are entertained of an amicable arrangement when the Committee report upon the question to the Board of Trade early in January. This decision, which is expected to be satisfactory to both sides, will likely be the precursor to further deliberations regarding the liability of the Railway Companies in the transit of coal, siding rates, and the 15 per cent. reduction on "smudge."

Northern Coal Trade.

The coal trade shows rather more irregularity; the best kinds of coal being steady in value with a full demand, while other kinds are plentiful and weaker in price. The lessened consumption of fuel in the iron trade is throwing some on to other markets, and making prices easier. In steam coals, best Northumbrians are steady at about 15s. 3d.

S&P

SAWER & PURVES

PREPAYMENT METERS.

WET AND DRY.

MANCHESTER & NOTTINGHAM.

M&N

per ton f.o.b., second-class steams are 14s. to 14s. 6d.; and steam smalls are weaker at 9s. 6d. to 10s. The collieries, however, are generally well employed, and exports are heavy. In the gas coal trade, there is a large delivery, especially of best kinds, and for these the price is firm. One or two collieries are rather short of work; the lessened deliveries to southern companies affecting them. Durham gas coals may now be quoted from about 12s. 9d. to 14s. 9d. per ton f.o.b., with 3d. extra for some special classes. As to contracts, one is reported, of about 22,000 tons, delivered over next year; and it is believed that the f.o.b. price is round about 12s. 4d. for second-class Durhams. Other sales are in course of arrangement for export at similar figures; but buyers seem to expect reduced prices. The coke market is weaker; and while there is the retention for gas coke for export of the price of 19s. to 19s. 3d. per ton f.o.b., there are lower quotations now being made for coke for household use.

Scotch Coal Trade.

The market shows no improvement. The foreign demand is going down rapidly. Contracts are keeping the collieries busy; but even with home buyers forward purchasing is not in favour, one reason for which is the closing of iron and steel works. The prices quoted are: Ell 14s. to 16s. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., and steam 13s. 9d. to 14s. Shipments for the week amounted to 270,722 tons—an increase of 1121 tons upon the preceding week, but a decrease of 20,881 tons upon the corresponding week of last year. For the year to date, the total shipments have been 13,017,013 tons—an increase upon the corresponding period of 729,122 tons.

The "Serious Burden" of Electricity at Rhyl.

The statement made by the Chairman of the Finance Committee of the Rhyl Urban District Council some months ago, as recorded in the "JOURNAL" at the time, that the electric light undertaking was a serious burden to the ratepayers, the annual loss upon it having steadily increased, is fully borne out by some statistical particulars which have lately been issued, bearing the signatures of the Town Clerk (Mr. A. Rowlands) and the Accountant (Mr. J. F. Bayliss). A sum of £27,698 had been expended on the undertaking up to the 31st of March last—leaving in hand a balance of about £260 of the original loan. For this outlay, what benefit have the ratepayers received? With the exception of one period (1903-4), when there was a profit of £85 on fifteen months' working, there has been a loss every year since 1901. It began with £314, and the next year it was £475; and the Rhyl and Prestatyn Light Railway Company forfeited £500. In 1904-5, the loss was £828; in 1905-6, it was £1050; and in the last financial year, £2149—the total being £4817. The undertaking has been aided to the extent of £2171 out of the general district rate, and there is to its credit the £85 of profit; so that the concern is £2561 to the bad. Electric lighting at Rhyl costs the ratepayers more than £1000 a year, between £800 and £900 being spent on arc lighting, as 36 of these lamps are kept going all through the winter so as to find an output for current. The District Council, it appears, acknowledge that this winter arc lighting is a great waste of money; but they continue it because "it helps the Electricity Department." For the "boon" of electric lighting, the ratepayers bear a "burden" of from 8d. to 9d. in the pound; and the consequence is that the Council are badly handicapped, and much-needed public improvements cannot be undertaken.

Potteries Federation and the Gas and Electricity Works.

To overcome the difficulty with regard to the financial aspect of the gas and electricity works in the event of the federation of various towns in the Potteries, Mr. J. S. Goddard, of Fenton, formulated the following scheme for the purchase of the existing gas and electricity works, and submitted it to the respective Councils: (1) The value of each of the four gas and electricity works, with all the plant, &c., shall be ascertained as at the time the new borough comes into existence; and from such ascertained values the amount of all outstanding loans (less amounts in sinking funds and reserve funds) in respect of each of the works, shall be deducted. Each such amount will be the sum to be paid for the purchase of the works, in respect of which this amount is the balance, to the town owning such works. (2) The method of adjusting payments of purchase to be as follows: It shall be ascertained what is the total amount to be paid by the new borough for the purchase of the gas and electricity works, as provided for in clause 1. It shall then be ascertained what is the proper proportion, based upon rateable value, that each town has to provide towards this sum. Each town will raise, through its district rate, annually a twentieth part of such sum, and pay the same into the borough fund. The new borough will pay out of the borough fund to each town the proper proportion to which it is entitled for the purchase of its works, as settled in clause 1. Interest should be paid upon the remaining outstanding amounts due from each town. (3) Valuation of works—(*a*) The value of each works might be taken to be represented by the amount of money which has been expended on capital account upon the works up to the date of purchase. (*b*) The basis of valuation might be settled by agreement between the representatives of the several towns owning the works. (*c*) The valuation might be left entirely in the hands of the valuers. (4) Repayment of loan instalments and interest: There are two obvious ways of dealing with these—(*a*) The payments may be made out of profits made by the gas and electricity works as at present. (*b*) The payments may be provided for out of the borough or district rate.

Lighting of Torrington.—It has been decided by the Town Council of Torrington to reduce the number of nights on which the moon is depended upon to give light. Hitherto the lamps have not been lighted for six or eight days about the period of full moon. This is to be reduced to four days in winter and six in summer; the Council being of opinion that neglect of lighting is false economy.

GAS-SWITCH

WORKED BY AIR PRESSURE ONLY.

The most Popular Exhibit at the Manchester Gas Exhibition.

OUR LATEST TESTIMONIAL.

St. Paul's Vicarage,
Oswaldtwistle, Lancashire.
October 19th, 1907.

The Pneumatic Gas Lighting Co. have just placed new fittings of Antique Copper and their patent system of lighting in our Church. The fittings are excellent, they adorn the Church, and will prove most serviceable in this damp climate. The effect of the lighting **is most brilliant.** The cost of the whole is moderate.

The Church originally had **194 gas lights,** they were reduced to **136** for the sake of economy, but the result was not efficiency. It is now lighted with **76 lights,** consuming considerably less than half the gas, and giving more than double the original illuminating power.

The effect is so brilliant that not only can the smallest print be read anywhere, but the nave, arcade, and roof are so illuminated that the **architectural beauty of the Church is greatly enhanced.**

This has been a "push job" as other improvements were in progress, before we became acquainted with the Pneumatic system, and the Bishop of Burnley had been secured to dedicate the new gifts on Oct. 12th. It seemed unlikely that the job could be done in time; but by working till midnight and all night once, the Church was **brilliantly lighted** on that occasion. The practical knowledge and energy of the indefatigable Managing-Director and his fitter are worthy of all praise, and I only wish other Contractors who had ample time had only done nearly as well.

The Church Council and myself, will be happy to show the Church lighted up, to any Clergy or Committees desirous of seeing this system of lighting applied to a large Church.

(Signed) THOMAS E. S. CATTERNS,
Vicar of St. Paul's, Oswaldtwistle, Lancs.

A few recent Installations—

Madame Tussaud's, London,
London County Council Fire Station,
New Council House, Smethwick,
St. Patrick's Cathedral, Auckland, N.Z.,
St. Giles' Church, Willenhall,
Theatre Royal, Chorley,
Radcliffe (Lancs.) Theatre,
Scarisbric Hall, Lancs.,
Royal York Hotel, Margate.

Prominent Clubs, Hotels, and Private Houses, &c.

Our System is too well-known throughout the Gas World to need any explanation in these Columns.

PNEUMATIC GAS LIGHTING CO. LTD.,

36, Farringdon Street, E.C.

Telephone 2123 HOLBORN. Telegrams: "OMNIBUSSES, LONDON."

Advertising the Advantages of Gas at Birmingham.

Quite a lively newspaper correspondence has been invoked by a "fighting" circular recently issued by Mr. G. Hampton Barber to the customers of the Birmingham Gas Department who are resident outside the city. It is explained that the reason for the step was that it had been brought to the notice of the Gas Committee that certain of these consumers had been approached with a view to inducing them to discard the use of gas in favour of electricity for lighting their premises. The circular then goes on: "In order that you may have information to guide you to a right conclusion, I am instructed to submit the following for your consideration. For lighting residential property, electricity at 4d. per unit is several times more costly than an up-to-date system of lighting with gas at 2s. 6d. per 1000 cubic feet. One ordinary incandescent gas-burner, lighted an average of three hours per day throughout the year, and yielding 65 candles of light, costs 12s. 4d. per annum with gas at 2s. 6d. per 1000 cubic feet; while a similar volume of light from ordinary carbon filament electric lamps, with current at 4d. per unit, would cost £4 13s. 5d. The combustion of gas in a properly ventilated room creates a good current of air, which helps to change and freshen the atmosphere to a greater extent than would be the case if electricity were used. If you will afford me the opportunity, I shall be happy to assist you by reviewing your present arrangements; and, if necessary, I will submit for your consideration, free of cost, proposals to secure a more effective lighting of your premises."

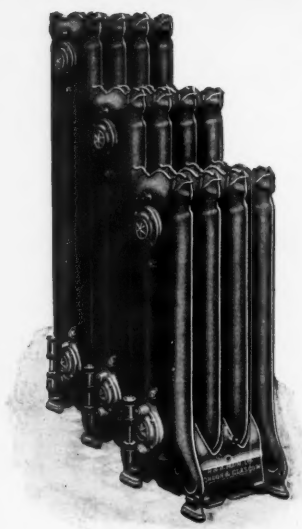
A Mantle Poster in Court.—Some no doubt welcome merriment was caused at the Law Courts last Tuesday during the hearing of a case in which an Earlsfield tailor was found to have broken the terms of his lease by converting a wall of his shop, which faced a church, into a bill-posting station. The Vicar of the church said that he and his congregation objected to the advertisements—particularly the "so-called humorous" ones, which were "much too usual." The posters were of a very varied character; but it was reported that one which was objected to "was that of a jolly-looking individual, with a ladder, smashing a street-lamp, without breaking a certain make of incandescent mantle." Whether or not there is too much humour in this advertisement may be arguable; but it is at least an equally arguable proposition that there is a corresponding lack of humour in some other directions. However, Mr. Justice Joyce thought the Vicar and Churchwardens were entitled to say they were annoyed with the "flaring advertisements;" and so there is an end to the matter.

Halifax Reservoir Leakages.—The Halifax Water Committee have received a report with respect to the leakages from the three reservoirs at Walshaw Dean from Messrs. George H. Hill and Son, the Engineers. Satisfaction is felt by the Committee at the reassuring nature of the report; the Engineers indicating that the defects are not at all serious, and that it is quite possible the means of egress may become choked. For the present there is nothing to prevent the full use of the reservoirs. They point out that such water as percolates through the strata about the embankments of the upper and middle reservoirs is received in each case into the reservoir below. The only water which is not stored, therefore, is the small quantity which shows itself on the side of the valley below the embankment of the lower reservoir; and even this will be utilized. The report concludes with the remark that, whether any remedial works will eventually be found necessary, it is yet somewhat early to predict; but unless the quantity of water to be dealt with increases very largely in future, nothing further may be required.

Gas Supply in the Brentford Company's District.—At the last meeting of the Twickenham District Council, the Lighting Committee reported that they had considered the minutes of a conference of Local Authorities, held in the Chiswick Town Hall, with regard to gas lighting. At the conference a report of the tests made in various districts from the commencement of the present year was under consideration, as well as information which had been obtained from local authorities and gas companies on the subject of the official burner used in testing, and as to the illuminating power of the gas supplied and the prices charged per 1000 cubic feet. The conference resolved to advise each Council to pass a resolution with reference to the appointment of a gas examiner, and recommended that arrangements should be made for a number of official tests to be carried out, after due notice to the Brentford Gas Company, and, in the event of the illuminating power of the gas being found to be below the required standard, that proceedings should be instituted forthwith against the Company, the cost to be paid *pro ratâ* by the Councils represented at the conference, on the basis of the rateable value of their respective districts. The recommendations were agreed to. The Surveyor reported that tests of the illuminating power of the gas supplied by the Company were made on Oct. 5 and 19, and that the results, corrected for temperature and pressure, were equal to 10·14 and 10·66 standard candles.

Lighting of Saxmundham.—The Watching and Lighting Committee reported to the last meeting of the Saxmundham Urban District Council that the Gas Company had tendered to light the town for eight months in the year for £87, nine months for £94, and ten months for £100. They offered an alternative scheme on the incandescent system as follows: Eight months, £100; nine months, £107; and ten months, £113. Attached to this alternative scheme was a condition by the Company that the contract should be for seven years. Mr. Jordan, the Chairman, said the Committee recommended that the tender of the Company to light the town for nine months in the year for £94 be accepted. He reminded the Council that in their alternative scheme the Company made it a condition that the contract should be for seven years certain; and he thought one reason for not accepting this was that the price of coal during the next seven years would probably not remain at the present high figure. Mr. Fairweather did not consider the town was well lighted. He used to regard Saxmundham as being better lighted than most towns; but they now seemed to have gone back. He also complained of the increase in price, and said that last year ten months' lighting could have been had for £94. Mr. Calver, on the other hand, remarked that he had heard some people complain that the light they got now was too much. Eventually the recommendation of the Committee that the tender of £94 for nine months' lighting be accepted was unanimously adopted.

RADIATORS



PLAIN OR ORNAMENTAL.

WHEN A TRAVELLER TELLS YOU HE IS SELLING THE BEST RADIATOR, YOU MAY BE SURE THAT IT IS

THE "ST. MUNGO" GAS HEATED STEAM RADIATOR

HE IS TALKING ABOUT.

FITTED WITH GAUGE GLASS,
GAUGE GLASS PROTECTOR,
GAS & AIR ADJUSTER,
AUTOMATIC AIR VALVE.
AUTOMATIC GAS REGULATOR,
FIXED CAST-IRON BASE,
AND ALL THAT IS BEST
IN RADIATOR CONSTRUCTION.

HIGHEST GRADE.

R. & A. MAIN, LD.,

LONDON, GLASGOW, FALKIRK.

The Progress of the Redhill Gas Company.—When referring to this matter in the last number of the "JOURNAL" (p. 584), it should have been stated that the consumption in the ten years 1896 to 1906 showed an average increase of more than 7 per cent. per annum; the figures for the former year being 69,631,000 cubic feet, and for the latter year 121,445,000 cubic feet—due mainly to the prepayment meter system, which has been in operation for years.

Additional Capital for the Gosport Water Company.—The invitation by the Directors of the Gosport Water Company for tenders for £3500 of 5 per cent. cumulative preference stock resulted in an over-subscription. The tenders in some cases went to an offer of 15 per cent. premium. The minimum fixed was £11 10s. for each £10 of the stock, which ranks for dividend with the existing £35,000 of 5 per cent. and the £4900 of 4½ per cent. preference stock. The additional capital is required for the new works at Soberton and the laying down of new mains in the Company's district.

Alleged Robbery from the Uppingham Gas-Works.—Last Saturday week, at the Oakham Police Court, C. B. Davis, a labourer, was charged with stealing a drill and a quantity of old iron, value 1s. 6d., the property of the Uppingham Gas Company; and A. W. Smith, another labourer, was charged with stealing from the Company brass fittings, to the value of £1 17s. 6d. They were both remanded on bail to the Petty Sessions. A rag and bone collector named Marshall, who was charged with receiving iron and brass knowing it to have been stolen, was remanded in custody to the Sessions.

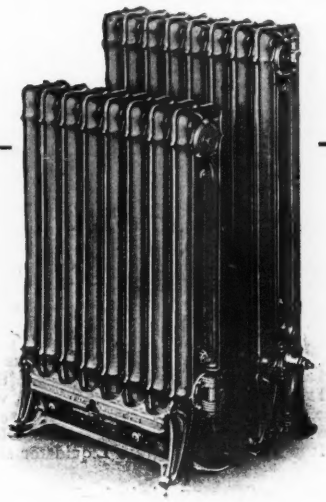
The Re-Imposition of Meter-Rents by the Gaslight and Coke Company.—The action of the Gaslight and Coke Company in charging meter-rents was considered by the Hampstead Borough Council last Thursday. A circular-letter had been received from the Islington Borough Council, asking for support in an appeal to the Board of Trade for an inquiry into the administration and expenditure of the Company; and the Lighting Committee recommended that no action be taken. An amendment was moved to support the Islington Council. On a division the numbers were equal; and the Lighting Committee agreed to reconsider the matter.

Lincoln Water Supply.—A special meeting of the Lincoln City Council was held last Wednesday, under the presidency of the Mayor (Mr. J. Mills), to consider the advisability of promoting during the ensuing session of Parliament a Bill to authorize the Corporation to provide an additional supply of water and further water-works for the city, and to extend their limits of supply. The Mayor formally moved a resolution to this effect; and Alderman Wyatt, in seconding, expressed the opinion that it was a step forward. He hoped the Corporation might get through the later stages of the matter as easily as they got through the proceedings that night. The motion was agreed to without further comment.

The Quality of London Water.—Notwithstanding the favourable reports of the Director of Water Examinations of the Metropolitan Water Board (Dr. A. C. Houston) on the quality of London water, Dr. W. Scott Tebb, the Public Analyst of the Borough of Southwark, recommends that London should, as soon as possible, abandon the Thames as a source of domestic supply. He points out that five out of the seven Commissions or Committees of inquiry who have investigated the quality of the Thames water have condemned its use for domestic purposes, and that the quality of the water as indicated by the analyses has shown no substantial improvement during the last thirty years. He holds that there is no reason to suppose that the poison of cholera or typhoid fever can be eliminated from drinking water by any practicable process of purification, such as filtration; and he considers that the substitution of a less hard water would be of great advantage on economic grounds.

New Issues of Capital.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Mr. Alfred Richards placed two new issues of capital by order of Directors. The first consisted of 600 ordinary £10 shares in the Lowestoft Water and Gas Company, ranking for a maximum dividend of 7 per cent.; the last dividend on similar shares having been at the rate of 5¼ per cent. per annum. They were all sold at from £11 to £11 7s. 6d. The other new issue was 500 "B" £10 shares (7 per cent.) in the Grays and Tilbury Gas Company; the last dividend on this capital having been at the rate of £5 12s. per cent. per annum. They fetched £10 5s. to £10 12s. 6d. each, *cum div.* from the 1st prox. Messrs. Chancellor and Sons offered for sale, at the Royal Hotel, Ascot, on Wednesday, 300 new £10 ordinary shares and £3500 of 4 per cent. perpetual debenture stock of the Ascot District Gas and Electricity Company. The shares were offered in lots of ten, and the debenture stock in lots of £100. Ten lots of ordinary shares and fifteen lots of debentures were sold at par.

New Joint-Stock Companies.—The following new Gas Companies have just been registered: Aberford Gas Company, Limited, with a capital of £2000, in £1 shares, to manufacture gas and supply light in the parishes of Lotherton-cum-Aberford, Parlington, and elsewhere, in Yorkshire; Bewdley Gaslight and Coke Company, Limited, with a capital of £6000, in £10 shares, a re-incorporation, with limited liability, of the Bewdley Gaslight and Coke Company, which was originally registered as an unlimited Company on April 23, 1868; and Caldicott and District Gaslight and Coke Company, Limited, with a capital of £6000, in £1 shares, for the purpose indicated in the title—the first Directors of this Company being Messrs. George Winstanley, J. L. Cloudsley, and J. Griffiths. The North Oxfordshire Water Company, Limited, has been registered with a capital of £15,000, in £10 shares (750 preference), for the purpose indicated in the title. The Atlas Tube and Fittings Company, Limited, has been registered with a capital of £1500, in £1 shares, to acquire the business of a tube and fittings manufacturer carried on by T. W. Grice as the Atlas Tube and Fitting Company (1905), at the Imperial Works, Cradley Heath, and the business of an anchor and chain maker carried on by him, as Gideon Billingham, at the Despatch Works, Cradley Heath. A Company under the title of James Dougall and Sons, Limited, Bonnyside Works, Bonnybridge, was registered in Edinburgh, last week, with a capital of £50,000, divided into 20,000 preference and 30,000 ordinary shares of £1 each. The Company will take over the business of fire-brick, &c., manufacturers, of James Dougall and Sons, Limited.



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Explosion at the Linacre Gas-Works.—On Sunday morning, shortly after eight o'clock, there was an explosion at the Linacre works of the Liverpool United Gaslight Company, by which six men were burnt about the face and arms, but fortunately not seriously. It appears the accident occurred during the cleaning out of a hydraulic main.

Failure of the Electric Light at Brighton.—Last Thursday night, a hitch in the working of one of the turbines at the Southwick generating station caused a temporary cutting off of the electricity supply of Brighton. Fortunately, the deprivation did not last more than about four minutes; and the lateness of the hour—eleven o'clock—rendered the occurrence less serious than would have been the case earlier in the evening. More inconvenience was experienced the following morning, when the current again failed for about ten minutes—this time, it is said, owing to a defective regulator.

West Suburban Gaslight and Coke Company, Limited.—Last Thursday, Mr. A. Edwards, the Liquidator of this Company, presided at a meeting of shareholders, held at the Institute of Chartered Accountants, to consider the result of the arbitration with the Uxbridge Gas Company with respect to the Colnbrook works (see *ante*, p. 433). Having referred to the circumstances which led to the arbitration, he stated that in the course of the proceedings certain things were disclosed which led him to obtain the opinion of Counsel, which was to the effect that all the papers in the case, particularly those relating to the promotion of the Company, should be laid before the Director of Public Prosecutions. It was decided that the Liquidator should take this course.

Saxmundham Gas Company, Limited.—The first annual general meeting of this Company was held last Thursday at the works, Saxmundham. In moving the adoption of the report, the Chairman informed the meeting that the works had now been reconstructed and brought into a thoroughly up-to-date condition. A trunk main had been laid into Kelsale, where a fair number of consumers had already been connected, and the Parish Church and other houses were being fitted up. The agreement for the purchase of the undertaking of the Yoxford Gas Company, whose district was supplied with gas from the Saxmundham works on the 22nd of August last, was approved. A dividend of 5 per cent. per annum both on the preference and ordinary shares, up to the 30th of June last, was declared.

Barry Gas and Water Managership.—The Barry Gas and Water Committee have received 52 applications for the position of Gas and Water Engineer, at a salary of £350 a year; and a short list has been prepared, from which a final selection will be made. The Clerk informed the Committee that he had received a letter, marked "Private," from a person who said he was a candidate for the position, and that if the Clerk would use his influence to get him the job he would be pleased to allow the Clerk 10 per cent. of his salary during the time of his employment. The Chairman (Mr. S. R. Jones) said the Clerk was greatly annoyed at receiving such a letter; and he thought in the interests of the town such a man should be excluded from the list. Personally, he was thankful to the Clerk for showing them the letter. The writer's name was suppressed; and it was agreed to exclude him from the list.

Messrs. James and Ronald Ritchie, Limited, ironfounders, of Middlesbrough, have had their name placed on the Admiralty list for cast-iron pipes and fittings.

The Birtley Iron Company have secured the contract for about 420 tons of 12-inch cast-iron pipes and specials for the new water-supply scheme at Broadstairs, Kent.

The Newport Gas Company have tendered at £2 10s. per lamp per annum for lighting the Carisbrooke district, and it has been accepted. The voluntary lighting arrangements in the area have not hitherto proved satisfactory.

Last Tuesday's "Gazette" contained the announcement of the local voluntary winding-up of the Castle Donington Gas and Coke Company, Limited; Mr. Ernest A. Browne, of Messrs. Derbyshire Bros., of Nottingham, being appointed Liquidator.

The Clerk has informed the Nuneaton Town Council that the agreement with the Gas Company with regard to lighting the street-lamps would terminate on Nov. 30, and the Company wanted 10s. per lamp extra for next year. He said this would make a difference of about £180 a year. The Highways Committee were deputed to see the Directors of the Company in reference to the matter.

Mr. Julius Norden writes to again call attention to the advantages gas companies experience on the Continent, and by already some few in England, in employing mantles on the public lamps uncollodionized. As has been amply demonstrated, not only is the quality of the light improved when the mantles are formed over the burners on which they will be used, but the durability of the mantle is considerably extended.

On behalf of the Local Government Board, Mr. A. D. Price last Tuesday held an inquiry at Kilkeel into an application by the Rural District Council for a loan of £4000 to carry out a water scheme. By their Act of 1893, the Belfast Water Commissioners are bound to give a free supply of not less than 50,000 gallons to the town of Kilkeel, provided the Rural Sanitary Authority lay the necessary mains. The Engineer in charge of the scheme is Mr. J. H. H. Swiney. Considerations of cost have led to a good deal of opposition to the proposals being manifested by ratepayers.

The Pneumatic Gas Lighting Company, whose apparatus was much in evidence at the Manchester Gas Exhibition, have lately completed an installation of their patent system of lighting in St. Paul's Church, Oswaldtwistle, Lancs. That the installation is a complete success is evidenced from the remarks made by the Vicar (Rev. Thomas E. S. Catterns), who, in the course of a recent communication, says: "The effect of the lighting is most brilliant. The cost of the whole is moderate. The church originally had 194 gas lights. They were reduced to 136 for the sake of economy; but the result was not efficiency. It is now lighted with 76 lights, consuming considerably less than half the gas, and giving more than double the original illuminating power."

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PARKINSON

STOVE COMPANY,

LIMITED.

NEW GAS FIRE DESIGNS

1907-8.

The "TOPAZ."

With GAS AND AIR Adjuster.

Boiling Burner fitted at top with separate cock

Single Row Fuel, Registered Design.

Particulars of other New Designs on application to

THE PARKINSON STOVE COMPANY, LTD.,

Stour Street, Spring Hill,

BIRMINGHAM.

The annual smoking concert and prize distribution in connection with the Hastings Gas-Works Cricket Club was recently held in the Board-room of the Gas Company's offices, which was decorated and illuminated for the occasion. Mr. Charles E. Botley, M.Inst.C.E., the President of the club, was in the chair; Mr. C. F. Botley occupying the vice-chair. Mr. W. T. Mills, the Secretary of the club, proposed "Success to the Hastings, St. Leonards, and District Amateur League," and said the club had won the trophy and medals for the third year in succession. Mr. Kendall having responded, Mr. Harvey du Cros, presented the trophy and challenge cup to the Chairman and the medals won to the various recipients. The medals were of greater value this year; the extra cost having been defrayed by Mr. C. E. Botley. Mr. Harvey du Cros proposed "The Club," which was cordially received, and responded to by the Chairman, who referred to the liberality of the Directors of the Company in starting it, and said it had since been self-supporting. Mr. C. F. Botley also responded, and said the season had been very successful. Prizes were then presented; and after two other toasts had been honoured, a musical programme was gone through.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER (SOUTH AMERICA). No. 4874.
MANAGER. Lisburn Gas Company.
GAS-FITTERS. Brentford Gas Company.
SERVICE LAYERS. No. 4873.

Situations Wanted.

REPRESENTATIVE. No. 4869.
ASSISTANT ENGINEER AND MANAGER. No. 4875.
MANAGER OR REPRESENTATIVE. No. 4872.

Investment and Directorship Wanted. W. E., c/o Horncastle's, London.

Plant (Second-Hand) for Sale.

BOILER. Redditch Gas-Works.
COAL-WAGGONS (SALE OR HIRE). Advertiser, Wills Street, Lozells, Birmingham.
METER (250-LIGHT). Tiverton Gas-Works.

Stocks and Shares.

ANNFIELD PLAIN GAS COMPANY. Dec. 11.
REDHILL GAS COMPANY. Dec. 3.
WALKER AND WALLSEND GAS COMPANY. Dec. 2.

TENDERS FOR

Fire-Clay Goods.
ROTHERHAM GAS DEPARTMENT. Tenders by Dec. 7.

Pipes, &c.
LEICESTER CORPORATION. Tenders by Dec. 7.

Sulphuric Acid.
SALFORD GAS DEPARTMENT. Tenders by Dec. 5.

Tar.
SHOTLEY BRIDGE AND CONSETT GAS COMPANY. Tenders by Dec. 11.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 617.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
268,324	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Oct. 30	7	Bombay, Ltd.	6¼—6⅝	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½—5	..	5 12 0
50,000	10	Aug. 29	14	Bourne- 10 p.c.	27½—28½	..	4 18 3
51,810	10	,,	7	mouth Gas B 7 p.c.	16½—17	+¼	4 2 4
53,200	10	,,	6	and Water Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	243—248	..	5 0 10
300,000	,,	,,	9½	Do. New	182—187	..	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100—103	..	3 17 8
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	205—215	−7½	5 4 8
246,320	,,	,,	8½	Do. A. Ord. Stk.	153—158	..	5 4 5
460,000	20	,,	10	British	39—41	−½	4 17 7
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	87—90	..	5 0 0
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	10⅞—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
150,000	20	July 12	8½	Cagliari, Ltd.	26½—27½	..	6 0 0
100,000	10	—	—	Cape Town & Dis., Ltd.	6—8	..	— —
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	7—9	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	108—110	..	4 10 11
1,443,280	Stk.	,, 29	5⅛	Commercial 4 p.c Stk.	100—105	..	4 19 0
560,000	,,	,,	5	Do. 3½ p.c. do.	98—103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	110—115	..	5 13 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	..	4 17 11
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17—18	..	5 0 0
15,182,590	Stk.	Aug. 15	4 1/16	Gas- 4 p.c. Ord.	92—94	+1	4 13 6
2,600,000	,,	,,	3⅛	light 3⅛ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	101—104	−2	3 16 11
4,193,975	,,	June 13	3	Coke 3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—98	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117	..	5 11 1
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	Nov. 14	8	Imperial Continental	168—170*	..	4 14 2
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A	221—223	..	4 9 8
718,100	,,	,,	7	Do. B	160—161	..	4 6 11
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	99—101	..	4 19 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 14	3⅝	Monte Video, Ltd.	10½—11¼*	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅞	Newc'tle & G'tesh'd Con.	106⅓—107⅓	..	4 6 1
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	89—90	−⅛	3 17 9
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	139—142	−2	5 12 8
60,000	5	Sept. 13	7	Ottoman, Ltd.	6—6⅛	..	5 7 8
398,490	5	Oct. 30	7	Primitiva Ord.	6⅛—7	..	5 0 0
796,980	5	July 31	5	Do. 5 p.c. Pref.	4¼—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Oct. 11	8	River Plate Ord.	12⅞—13¼	+⅛	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	−1	4 4 3
250,000	10	Sept. 27	8	San Paulo, Ltd.	13—13⅛	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	243—245	..	4 1 8
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,500	,,	,,	10	Do. C	243—245	..	4 1 8
70,000	10	Nov. 14	10	South African	14½—15½*	..	6 9 0
6,429,895	Stk.	Aug. 15	5⅛	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 15	5⅛	S'th Suburb'n Ord. 5 p.c.	114—117	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.	104—109*	..	4 11 9
120,000	Stk.	Aug. 15	6⅔	Tottenham A 5 p.c.	120—123	..	5 9 9
398,940	,,	,,	5½	and B 3½ p.c.	100—103	..	5 1 11
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10½—..	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6⅔	worth B 3½ p.c.	128—133	..	4 17 9
75,000	,,	,,	5⅜	and C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney 3 p.c. Deb. Stk.	75—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	100—103	−2	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	101—104	..	3 16 11

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(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the Supply of about 1800 Tons of SULPHURIC ACID, to be delivered during the Year 1908.
Full Particulars may be obtained on Application to Mr. Wm. W. Woodward, Engineer, Gas Offices, Bloom Street, Salford.
Sealed Tenders, endorsed "Tender for Acid," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m. on Thursday, the 5th of December, 1907.

L. C. EVANS,
Town Clerk.

Town Hall, Salford,
Nov. 21, 1907.

COUNTY BOROUGH OF ROTHERHAM.

THE Gas-Works Committee of the Rotherham Corporation are prepared to receive TENDERS for the Supply of RETORTS and FIRE-CLAY GOODS.
Specification, Quantities, and Form of Tender may be obtained upon Application to Mr. J. S. Naylor, Engineer and General Manager.
The person whose Tender is accepted will be required to enter into a Contract which will contain the usual fair-wages clause.
Tenders, endorsed "Retorts and Fire-Clay Goods," to be sent to me not later than Saturday, the 7th of December next.

By order,
W. J. BOARD,
Town Clerk.

Town Hall, Rotherham,
Nov. 20, 1907.